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Editorial Management

With this issue of *Railway Engineering and Maintenance of Way,* Mr. Kenneth L. Van Auken assumes editorial charge of this publication. Mr. Van Auken leaves the position of Editor of the Signal Engineer and Associate Editor of the Railway Age Gazette. He is eminently qualified for this position, both because of his training in editorial work, and because of his experience as a railroad man.

Never before in the history of the American railway transportation systems has the railway journal been any more necessary to the railway man than today. This publication has a peculiar and particular field of its own. It deals with problems tremendously important to the railroads and the greatest care will be taken to insure that the problems which naturally come within the scope of *Railway Engineering and Maintenance of Way* are treated in a way that will be of practical value to its readers.

BRUCE V. CRANDALL, Publisher.

Both Sides of the Fence

"*Railway Engineering and Maintenance of Way* is not a paper exclusively for the railway man, nor exclusively for the railway supply man. It is for both of them and equally so." This statement appeared in the Publisher's Announcement of the change of ownership of this publication a few months ago.

There has been a sort of an unwritten law among editors and publishers of railway journals and magazines to the effect that a railway paper was published for its subscribers. This perhaps is all right and as it should be; but it has seemed to be taken for granted that only railway men were subscribers to railway publications. The supply man seems to have been overlooked. There is no reason why we should make any division between the railway man and the railway supply man—a sort of dividing the sheep from the goats. There is no doubt that the railway supply man is very often the goat, but so is the railway man for that matter. The fact that a man has something to sell makes him no whit the worse than the man who buys from him, nor does it make him any better; and the fact that a man advertises in a paper is no reason why he should be considered as an outlaw; neither should he be given the publication as a present if he is a particularly large advertiser.

This publication is to take a somewhat new position in that it boldly announces it is published not merely for the benefit of its subscribers, but for the benefit of every man who has to do with railroading, directly or indirectly —who may be interested in the special problems of railroading which naturally belong in its field. Edited in this manner it becomes of the greatest possible benefit to the subscriber, the prospective subscriber, the casual reader, and the advertiser.

There are certain problems to be solved in railroad-

ing. The railroad man has his part and the railway supply man his part. The existence of this publication is justified only by being of all possible help and assistance to both the railway supply manufacturer and the railway man.

Permanency of Steel Bridges

One reason cited against the use of structural steel for bridges is that a steel structure is not a permanent one. Yet, it has hardly ever happened that an old steel structure had to be replaced merely because of the material being outworn, except when the structure was not properly maintained. As a matter of fact, old structures are usually replaced by new ones because the old ones were designed for lighter loads than those prevailing at the time of replacement. It can be said that the majority of bridges or similar structures reach the limit of their serviceability before they are outworn. Painstaking maintenance is, of course, essential to produce this result.

Even in the case of structures actually outworn by service, it is not so much because of the age as it is because they have been overstressed for long periods of time before reinforcement or renewal is resorted to. It seems reasonable to assume that if bridges built now are subjected to a traffic much heavier than they are designed for, they will need reinforcing or renewal after twenty years regardless of the material used in their construction.

The claim of permanency for concrete bridges is based on the record of masonry bridges which are centuries old. If those bridges are properly analyzed, however, it will be found that in most cases the stresses are very low, even under the heaviest imaginable loads. When those old bridges were erected steel bridges were unknown. If steel bridges were built with a corresponding excess of material, to insure correspondingly low stresses, there is little doubt that steel structures properly maintained would also last a very long time. Some of the steel bridges which were constructed before the entire theory of trusses was known and with a large excess of material to insure safety, bear out this statement.

The Advertising Value of Concrete

One very valuable asset of concrete bridges and bridge floors which is very seldom emphasized or made use of, is the feeling of security and safety instilled in the minds of passengers when they know that the structures they ride over are built of concrete. This, if properly made use of in advertisements of passenger service, will no doubt add to the revenue of a road. Where several lines connect the same points, most of the travelers will use the line which has the best rolling stock and roadway structures, other conditions being equal. That this is not an idle fancy is proven by the fact that ballasted floor bridges were adopted as standard by one large road at the instance of the President, for this reason.

The layman does not readily comprehend the mechanics of a steel truss or other complicated steel structure, but grasps at once the action of a concrete slab or an arch bridge. The very massiveness and outline of these structures suggest strength, and at once convey to the observer that idea, which satisfies the mind as to safety. In passing over a steel bridge, a passenger feels much more secure if he notes that the floor is a solid, ballasted one instead of the ordinary open timber floor which betrays its presence by the attendant rumbling. The solid-floor bridge allows the use of continuous ballasted track which is "easier riding" and not subjected to the sudden jolts so common where tracks pass from open floor to ballast or vice versa. The general passenger agent who can point to lines having permanent concrete bridges for the most part, and concrete floors on steel bridges, is a fortunate individual, for he has an advertising "talking point" of far reaching value. It is rather surprising that this feature of permanent-way construction has not been exploited more before the general public.

Intensive Development

Progress is the constant advance on the road from crudity toward perfection. In practically all industries the development is from the extensive toward the intensive. We hear much nowadays about intensive cultivation by farmers; naturally the railways encourage this movement as tending to intensify traffic.

In railways the development has been much the same, a great many appliances having been used in the early stages which were too strong or too cumbersome for the purpose they served. They were the best to be had, however, and were used until better devices, or those which serve the same purpose and use lesser material, were developed.

There has been a strong tendency in recent years to combat the introduction of railway devices or tools of an entirely new kind which would add to the amount of equipment. At the same time keen interest has been evinced in improvements to the older, more cumbersome or less satisfactory appliances, and in this development anything which will decrease the amount of equipment or number of tools can attract attention.

We publish on another page of this issue, and article describing a new multiple-filament signal light which is designed to displace the use of two bulbs at a signal. At present these two bulbs are so arranged that when the light in the primary or first bulb gives out on account of the failure of the filament, current will be connected into the other emergency bulb and thus insure constant illumination.

The multiple-filament lamp operates in much the same manner, but one bulb is eliminated, thus reducing the amount of room necessary, and of greater importance still, allowing the emergency as well as the primary filament to be placed at the focal point in the lamp.

Structural Materials

While there is an uninterrupted change in the uses of structural materials going on, owing to the increase in our knowledge of the materials and their properties, such a development is gradual and usually not in the nature of a revolution. It is different when a new material or a combination of materials is invented and found practical for many uses in the field of structural engineering. A new building material calls for new theories and methods of application and such must be gradually developed by incessant labor and by the careful study of successes and failures. Erroneous opinions often exist which are based on superficial study or on wrongly interpreted results of experiments. It takes a long time to discover and make known their importance and to disseminate this knowledge so that it becomes the common property of the enginering profession.

It is but natural that the controversy over a new material of wide adapability should occupy the minds of the engineers more than the study and development of old and generally known structural materials. This has been the case with reinforced concrete, which has to a certain extent pushed structural steel into the background. We may be well satisfied with this condition for it is due to the tremendous amount of work done for the promotion of the use of reinforced concrete and the study of the new material, that today we are in a position to compare it with the older ones, especially with structural steel, without prejudice and with a fairly complete knowledge of the possibilities of both materials.

We believe the interest of engineers in the development of structural-steel engineering at the present time is steadily growing. One of the reasons for this is, that although it was supposed to be given second place except for long-span bridges and high office buildings, even today it is fully holding its own in the competition with reinforced concrete.

The unprecedented development of reinforced concrete for railroad and other structures must be ascribed to its adaptability to both super and substructures. Prior to the introduction of reinforced concrete in structural engineering, masonry was almost exclusively used for substructures and structural steel for superstructures of bridges. The new material resulted in heavier superstructures, and lighter substructures where used for both parts of a bridge. New ideas of economical design have become the logical consequence of the development of reinforced concrete engineering, and these have caused more careful study with a view to bringing out the great advantages of structural steel, especially for railroad structures.

Today it is generally admitted that the economy of steel structures of many types cannot be doubted. Besides, there are other types of structures which have always remained in the undisputed domain of structural steel engineering. Many assumptions regarding the permanency and other properties of reinforced concrete are being revised as a result of tests, and some hasty conclusions regarding reinforced concrete structures have been found to require modification. Forced to compete with concrete, structural steel has demonstrated that it still has a great future in the broad field where it excels all other materials. It is of utmost importance to learn from recent experience the lesson of economy of design; and it is the plain duty of every steel engineer to assist in throwing as much light as possible upon the advantages of steel over reinforced concrete for certain classes of railroad structures.

Maintenance Articles

It is our purpose to publish within the next few months, articles on a number of subjects of live interest to trackmen. Among these are the following: (1) Program of work—a complete discussion of the different kinds of work which should be done in each season of the year, and the order in which each season's work should be done, with reasons for such a program; (2) motor cars—information and actual data on the economies effected and the increased contentment of laborers and foremen who use motor cars; (3) ditching—a discussion of ditching from both the construction and maintenance viewpoints, including methods for keeping ditches open and in best condition to drain the track effectively; (4) track tools and devices—the advantages of using high-grade tools, especially on regular section work, caring for tools, new track tools or devices which have been found to be of exceptional help, or combination tools which have decreased the number necessary to carry with the gang.

The way in which work should be arranged has a decided effect not only on the amount and quality of work accomplished, but on the ease of doing it. Many trackmen seem to get a good deal more work done than others who work harder, and investigation will often show that this is the result of an expenditure of brain energy in arranging the work so that every move is a definite and permanent step forward. For this reason a discussion on the subject of the way track work should be arranged, giving reasons therefor, should prove valuable in promoting a systematic procedure which will guarantee maximum efficiency.

A lot of information is available on the subject of motor cars, but there is a dearth of actual data which can be presented to a superior officer to *prove* the economies and other benefits which can be assured by the use of a car which will give dependable service.

Nearly all trackmen concede that drainage is one of the most important features of track maintenance. The solution of a great many problems in track work can be traced back to correct methods of drainage and ditching. Track and surface ditches take care of the drainage in most of the track in cuts, and we believe that there is

ample opportunity for a valuable discussion on the subject of ditching.

The advantages of taking good care of tools and always keeping them in shape to do the best work is well recognized, but many trackmen are careless in this respect. The substitution of more efficient devices and tools and the substitution of combination tools for several old ones gives an opportunity to bring out information heretofore unpublished, which if applied, will result in increased ease of work, which assures better satisfaction among laborers.

Contributions from our readers on any of these subjects, with or without illustrations, are solicited and will be paid for at space rates when published. Communications should be addressed to Editor *Railway Engineering,* 1824 Lytton Bldg., Chicago.

Plate Girder Bridges

The most economical bridge of a certain span is not always that involving the least quantity of material. The steel plate girder bridge is for average spans one of the simplest and best solutions for the superstructure and very often its economical superiority over other types is clearly apparent. The plate girder is easily analyzed and designed, and it involves shop work of a very simple and therefore inexpensive character, and the erection usually presents no uncommon difficulties.

Several features of the design of plate girders and their details are treated differently by the different railroads and bridge shops. A complete survey of present railroad practice in plate-girder bridges will appear in an early issue of *Railway Engineering,* which we believe will be of more than passing interest to our readers. A larger sum of money is yearly invested in plate girders for railroad bridges than in any other type of bridge superstructure.

Anthony Gibbs & Co., New York, are inquiring for one first-class coach, one second-class coach and one baggage car for export to Chile.

The Chesapeake & Ohio has placed an order for 700 box cars with the Central Locomotive & Car Works and is in the market for 50 caboose cars.

Darling & Co., Chicago, are in the market for 15 tank cars.

The Delaware & Hudson is inquiring for 18 coaches and 6 baggage cars.

The Detroit, Toledo & Ironton is inquiring for 200 40-ft. 40-ton steel underframe box cars.

The Railroad Construction Co., 80 Fifth avenue, New York, is making inquiries for 10 passenger cars for the Glen Rose & Walnut Springs of Texas.

The Havana Central is in the market for 500 20-ton and 50 30-ton flat cars, 100 30-ton box cars and 10 30-ton cabooses.

The Lehigh Valley is about to repair 2,000 box cars and the work has been divided between the American Car & Foundry Company and the Standard Steel Car Company.

LETTERS TO THE EDITOR

Track Scale Specifications

To the Editor:

In your March number on page 82 suggestions were given for track scale specifications, with some details of which the writer does not agree.

In 4 (a) regarding the designing of scales with suspended bearings: If this specification was adopted it would bar two designs in use at present for protecting the pivots from displacement and injury. I do not think that the suspension bearing has yet proven itself to be superior to the ball or roller bearing, nor to be so greatly better than the old superimposed type.

In section (b), with regard to number of sections, I do not think that the number should depend entirely on the length of the the weigh rail. The point where more than four sections will be found desirable will probably be that point where the great weight of scale levers and weigh bridge in the long section, produce an inertia in excess of that of the friction of the added parts in more than four sections. This will depend upon the length of the scale irons and may not be the same in scales of the same length of weigh rail.

In (c) the conclusion favoring a continuous girder is opposed by nearly all the evidence gained in scale tests, as no weigh bridge yet built in this form has been free from deflections under load. A continuous weigh bridge adds from one-fifth to one-fourth to the load on each section of the scale. A test with a distributed load does not give dependable results as in practice the loads are concentrated.

In (5-a) if a change is to be made in the definition of the capacity of a scale, one more comprehensive should be adopted. As was shown by the writer in the January issue of this publication, the load upon a lever in weighing a car is at no time greater than one-half the weight upon one pair of trucks or, say, 45,000 lbs. There are two requirements which a scale lever must fulfill. It must not deflect enough to transmit inaccurate weights to the beam, under the loads which come upon it in weighing, and it must not be strained too close to its elastic limit in the abuses which it will meet in service. The lever will be subjected to a load of from 60,000 to 96,225 lbs., depending upon the length of the section span. If we are going to have a specification to meet the conditions, it must provide a lever which will not be loaded to more than 75 or 80% of its elastic limit with the maximum load which a moving engine will bring upon it, or say its static load plus 25% for impact.

It does not appear to me that the fibre stresses are well chosen. Is it wise to adopt a low fibre stress and bar a manufacturer who may wish to use better-grade material? The knife edge should be of such length that under the abuse of an engine running over a scale under its own power the edge will not be injured. The weight which may be imposed without danger, if not too often repeated, is probably not far from 8,500 lbs. per inch. If not more than the load specified in the clause be used, it will give a length of 12 in. to the main knife edge. The maximum load which the moving engine will place on such a knife edge per inch will be governed by the length of span between sections, as follows:

Length of Span	Without Impact		With 25% Impact	
	Total Load	Per in.	Total Load	Per in.
13 foot span.....	73,874	6,156	92,342	7,695

14 foot span.....	78,214	6,518	97,767	8,147
15 foot span.....	82,000	6,833	102,500	8,541
16 foot span.....	85,312	7,109	106,640	8,887
17 foot span.....	88,238	7,353	110,297	9,191

It seems to me that if we are to amend the specification, we should try to get nearer existing conditions. From the above table it is clear that a knife edge 12 in. long is likely to be injured if an engine passes over it under its own power.

Would it not be better to lower the load per inch if the stated load is to be used? Engines do get on scales and is it good policy to buy a scale which will be ruined if this happens occasionally? The A. R. A. specifies that the maximum load on a pivot should be 7,000 lbs. per lineal inch. The amendment suggested would exceed this without any allowance for impact. No one familiar with track scales will claim that an engine moving under its own power will not put a greater strain upon a scale, than an engine placed on the scale by another engine.

A. M. VAN AUKEN.

R. S. A. MAY MEETING

The May meeting of the Railway Signal Association was held at Hotel Astor, New York City, May 26 and 27, President T. S. Stevens presiding. A goodly number of members were in attendance.

Papers were submitted by committee 3—Power Interlocking, committee 5—Manual Block, committee 6—Standard Designs, committee 8—Electric Railway and A. C. Signaling, committee 10—Storage Battery and Charging Equipment, special committee—Electrical Testing, and special committee—Lightning Protection.

Committee 3 presented revisions of the specifications for electro-pneumatic interlocking and for fiber conduit. Specifications for incandescent electric lamps were also presented as a progress report. Eight drawings of electro-pneumatic circuits were submitted to supercede the old ones in the Manual.

The committee on Manual Block submitted a paper on the care and maintenance of dry batteries; also three sets of instructions covering the maintenance of dry cells, maintenance of gravity cells and maintenance of caustic soda cells.

The committee on Standard Designs submitted four revised drawings and four new standard plans. The revised drawings are (1056) terminal block, (1059) clamp for base of ground mast signal, (1065) blade for upper-quadrant signals, showing the colors most favored, and (1070) binding post. The new plans are (1360) showing tang ends with screw jaws, (1361) adjusting crank and assembly, (1390) non-insulated switch adjustment bracket, and (1391) insulated switch adjustment bracket.

A set of specifications for reactors for line and track circuits was presented by the committee on Electric Railway and A. C. Signaling. The committee on Storage Battery and Charging Equipment submitted a revision of the specifications for nickel-iron, alkaline storage batteries, which eliminates certain features which under the former specifications could be furnished by only one manufacturer under patent rights. Typical cost figures were also submitted for the various methods of charging storage batteries.

The committee on Electrical Testing submitted a number of forms for recording the results of track-circuit and relay tests and also a table classifying the instruments for inspecting various types of a. c. and d. c. circuits.

The special committee on Lightning Protection submitted revised specifications for vacuum-gap and air-gap lightning arresters, and choke coils. After the adjournment of the Convention on Wednesday, the members were guests of the Signal Appliance Association on a trip up the Hudson River to West Point. Refreshments were served on the boat, "The Grand Republic," and one hour was spent in viewing the grounds and buildings at West Point.

TRACK SCALES FOR THE SOUTHERN

The Southern Railway Company recently placed an order for twenty-two, 150-ton scales of the type shown in the illustration, to be installed during the Summer. The scale is a type in which the platform is supported on suspension bearings, so there is no movement to any of the levers when swinging the platform. The Southern requires special suspension bearings with four links in order to pervent any rocking of the bearings on the pivots or knife edges. Several of the scales will be installed for motion weighing where a Streeter-Amet attachment for recording the weights will be used in connection with the scales. The scales are 54 ft. four-section with 50 ft. live rails, stationary decks and dead rails.

The bridge beams on all the scales will be spliced with a flexible connection over each of the intermediate sections in order to reduce the reaction of the intermediate sections to a minimum when coupled cars pass over the scale; this flexible splicing of the beam also prevents the bearings of the end sections from raising up when a heavy load is placed on the center span of the scale. The method of splicing the beam used by the Southern is patented by H. O. Hem of the Strait Scale Co., Kansas City, which company is furnishing the 22 scales described herein.

View In Pit of One of Southern's New Scales

The Chicago & North Western is reported in the market for additional locomotives.

The Eureka Nevada is in the market for one locomotive and has one locomotive for sale.

The Fort Worth & Denver City is reported to have ordered 10 locomotives from the Baldwin Locomotive Works as part of an order of the Chicago Burlington & Quincy recently reported.

Culvert Construction, B. R. & P.

Account of Unusual Method Used in Constructing a Large Double Arch Culvert Under Traffic

By A. M. Wolf, C. E.

When timber trestles are replaced by culverts and earth fill, the usual procedure is to build the culvert without interfering, or with only slight interference, with the existing structure, either by placing the culvert between existing bents or by building around the bents if the culvert is large. In the construction of a large double-arch culvert over Canoe Creek near Cloe, Pa., on the Indiana Branch of the Buffalo, Rochester & Pittsburgh Ry., an unusual method was used. The culvert was built when double tracking the line, in a fill 850 feet long, having a maximum height of 40 feet; it replaced a single track framed bent trestle. (See Fig. 2.) The bents immediately over the proposed location of the culvert were replaced by a temporary deck truss span, and the culvert was built underneath without hindrance to, and without delaying traffic.

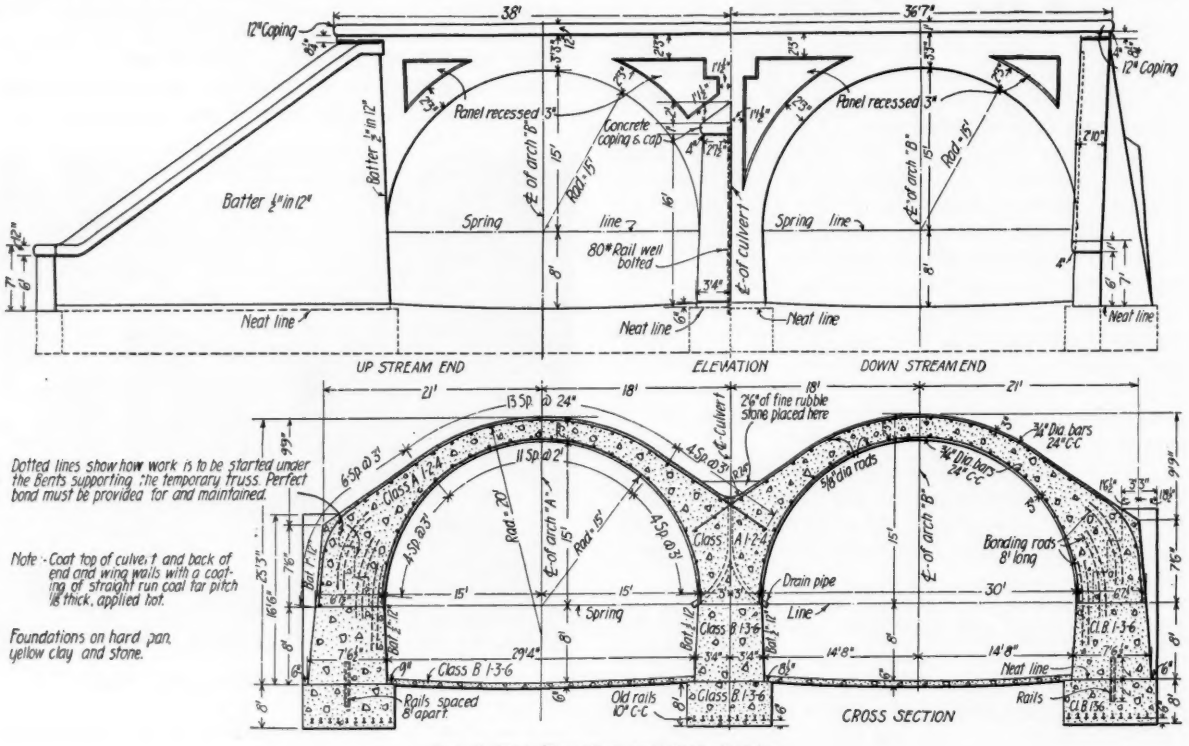

12" Coping
38'
36'7"
Panel recessed 3"
Concrete coping & cap
Batter ½" in 12"
℄ of arch "B"
Rad. 15'
Spring line
80# Rail well bolted
℄ of culvert
Neat line
UP STREAM END
ELEVATION
DOWN STREAM END
Dotted lines show how work is to be started under the Bents supporting the temporary truss. Perfect bond must be provided for and maintained.
Note - Coat top of culvert and back of end and wing walls with a coating of straight run coal tar pitch ⅛ thick, applied hot.
Foundations on hard pan, yellow clay and stone.
26" of fine rubble stone placed here
¾" Dia bars 24" CC
⅝ dia rods
Bonding rods 8' long
Drain pipe
Class A 1-2-4
Class B 1-3-6
Rad. 20'
Rad. 15'
℄ of arch "A"
℄ of arch "B"
Rails spaced 8' apart
Old rails 10" C-C
Rails
CROSS SECTION

Fig. 1—End Elevation and Cross Section

DETAILS OF DESIGN

The culvert consists of two 30 ft. semi-circular reinforced concrete arch spans, 78 ft. long and 33 ft. high, resting on plain concrete abutment and pier walls. (See Details Figs. 1 and 3.) These walls, 8 ft. high, rest on footings 8 ft. thick, reinforced longitudinally by old rails weighing 60 lb. per yard placed 6 in. above bottoms of footings and spaced 10 in. centers. The abutment walls were tied to the footings by dowels formed by old rails 4 ft. long, spaced 8 ft. centers. The walls have a face batter of ½ in. to 1 ft. and a back batter of 1 in. to 1 ft. The upstream end of the center pier projects 7 ft. 10½ in. beyond the face of the culvert and is carried up 17 ft. above the footing as a cut water. It is beveled at 45 deg. with a point batter of 3 inches in 1 ft., protected by an 80 lb. rail anchored to the concrete. A 1:3:6 mixture was used for all parts of the structure below the springing line of the arches.

The floor of culvert consists of a 6 in. concrete slab sloped from sides to center and extending out to the end of wing walls where it terminates in a bulkhead wall 12 in. thick, which is placed 7 ft. deep at the down-stream and 8 ft. deep at the up-stream end, to prevent scour and undermining.

The wing walls are of the gravity type with a top width under coping of 2 ft. 6 in., the coping 1 ft. thick projecting 4 in. at the face. The top wings have a slope of 1½ to 1 except for a distance of 2 ft. 4 in. at the ends where it runs horizontal, the change being effected by the use of a slight curve in the top of the coping which adds much to the appearance of the structure. The copings are reinforced with one ⅝ in. dia. bar in each corner to prevent cracking. A rich mixture, 1:1:2, was used for all copings, including that on the parapet walls.

The arch rings, 2 ft. 3 in. thick at the crown, are reinforced longitudinally with ¾ in. diameter bars, on 2 ft. centers near both extrados and intrados, and carried down to the skewbacks or tops of abutments and pier which were finished off horizontally. Transverse reinforcement is also used in the top and bottom of the arch ring, spaced as shown in Fig. 2. The concrete used in arch rings was of a 1:2:4 mixture.

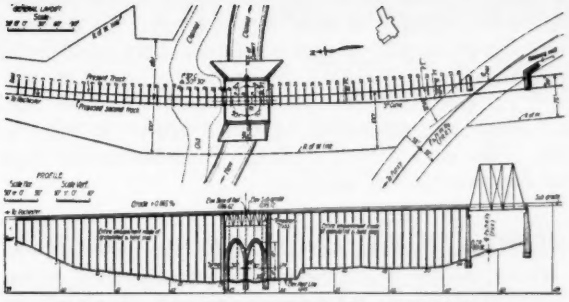


Fig. 2—Location Plan and Profile, Canoe Creek Culvert

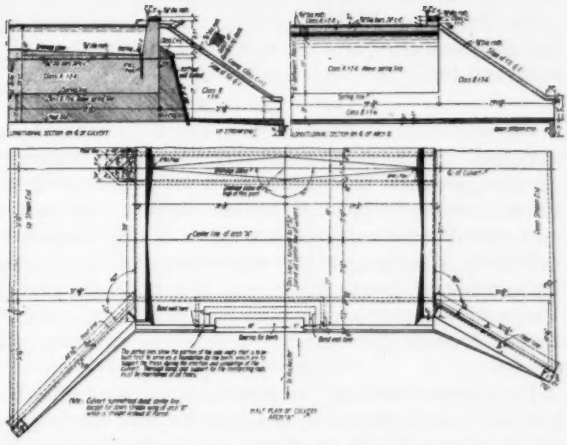


Fig. 3—Plan and Longitudinal Section of Culvert

The parapet walls are of the gravity type with a top width of 2 ft. 6 in., a back batter of 2 in. in 1 ft., and a vertical face. They are carried up 1 ft. above the crown of arches and capped with a 1 ft. coping of the same design as used on the wings. The face-parapet walls are recessed over arch haunches as shown in Fig. 1.

A concrete saddle over the center pier conducts the seepage to 4 in. wrought iron pipe outlets carried down through the pier at each end. (See Fig. 3.) All culverts now built by the B. R. & P. Ry. are designed for a live load equivalent to Cooper's E. 60.

CONSTRUCTION METHODS.

The construction of the culvert was begun by building up a portion of the side walls or abutments directly under the timber trestle to a height of about 15 ft. 6 in. above neat line, as shown in dotted line in Figs. 1 and 3, to serve as a foundation for the timber bents which were built up to support the temporary truss span during construction of the remainder of the trestle. The culvert was located so as to bring the sidewalls between the timber bents of the existing trestle so that they did not have to be disturbed until the truss span was placed.

When the portion of sidewalls serving as seats for the temporary construction had hardened sufficiently, a triple bent was erected on each wall, the timbers being securely bolted together and sway-braced to form a single bent as shown in Fig. 4. The two inside frames of these bents were cut down so as to form a bridge seat for the 79 ft. steel deck truss span, the outer frame being carried up to support the ends of trestle stringers. The timber trestle between these bents was next removed, the

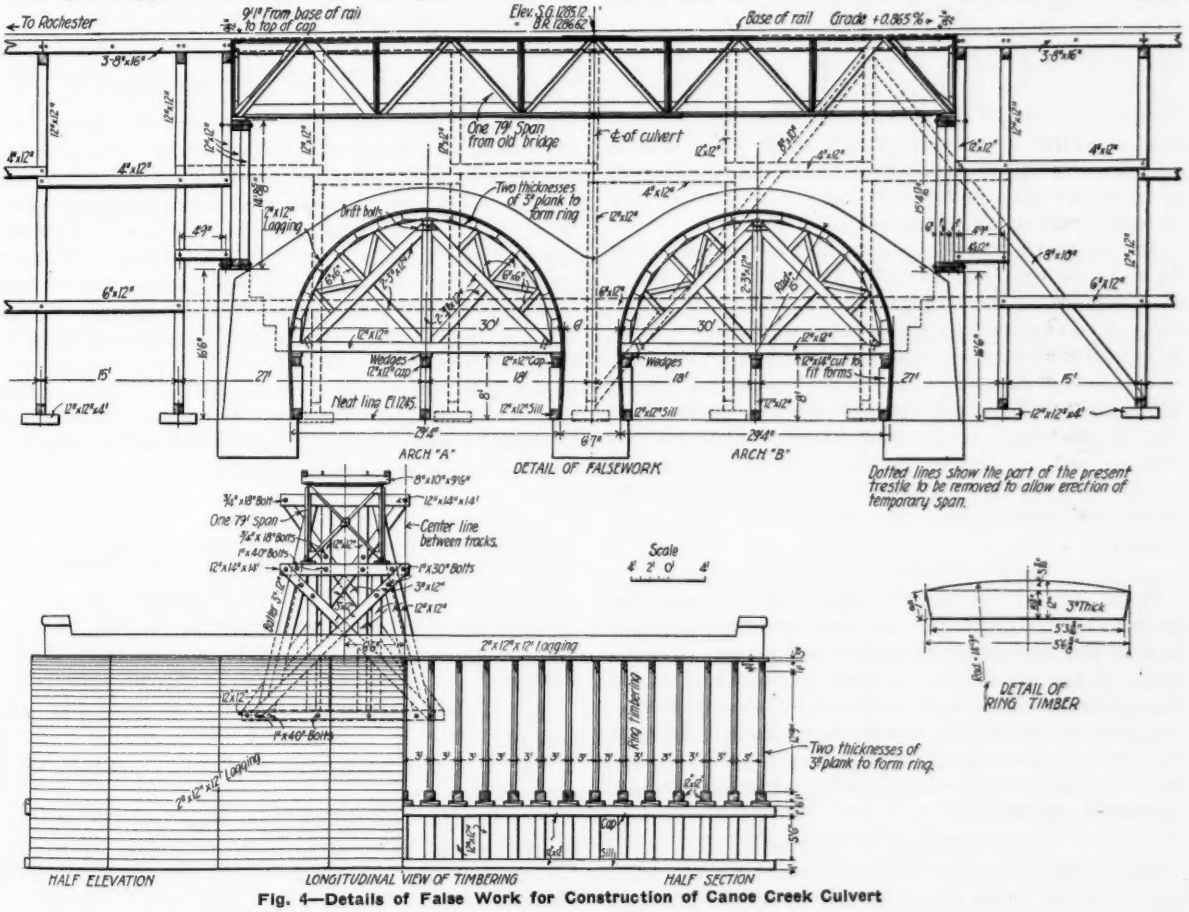

To Rochester
9½" From base of rail to top of cap
Elev. S.O. 1285.12
B.R. 1286.62
Base of rail Grade +0.865%
One 79' Span from old bridge
℄ of culvert
Two thicknesses of 3" plank to form ring
Drift bolts
2"x12" Lagging
Wedges
Neat line El. 1245
ARCH "A"
DETAIL OF FALSEWORK
ARCH "B"
Dotted lines show the part of the present trestle to be removed to allow erection of temporary span.
Center line between tracks.
Scale
Two thicknesses of 3" plank to form ring.
Ring Timbering
3" Thick
DETAIL OF RING TIMBER
HALF ELEVATION
LONGITUDINAL VIEW OF TIMBERING
HALF SECTION

Fig. 4—Details of False Work for Construction of Canoe Creek Culvert

truss span erected and the track laid on it.

The remainder of the abutment and pier wall footings was then concreted and the erection of the timber falsework and the arch spans was begun.

ARCH CENTERS.

The arch centers of the modified bow type (See Fig. 4) were built on the ground and erected at 3 ft. centers on 12 x 12 in. caps just below the spring line, at center and end of span. These caps were supported by 12 x 12 in. posts directly under the trusses, taking bearing on 12 x 12 in. sills, those at the sides resting on the footings while those at center of the span rested on the ground. The centers were blocked up on hardwood wedges on the caps to level up the forms and to allow the centers to be struck.

The centers consisted of a 12 x 12 in. horizontal bottom cord or tie member, and ring timbers made up of two thicknesses of 3 in. plank, cut to the curve of the arch ring, and securely nailed together. These plank bows were cut in pieces about 6 ft. long and the splices staggered. To stiffen up the bows, secondary inclined trusses of four panels were formed in the centering, spanning from the springing line to the vertical post at the crown, the bottom chord consisting of two 3 x 12 in. timbers supported at the center by a radical strut composed of two 3 x 12 in. plank spiked together. The web members of these stiffening trusses were 6 x 6 in. timbers. (See Fig. 4.) Upon the centers, 2 x 12 in. lagging in 17 ft. lengths was laid to serve as a form for the arch ring concrete. Ordinary plank forms were used for the back forms of the abutments up to the intersections with the extradoses of the arches.

CONSTRUCTION.

After completing the forms, the abutment and pier walls were completed up to the springing line. The arch ring reinforcement was then placed as shown in Fig. 1, blocked up to proper position on the forms, and the arch rings concreted in sections parallel to the center line of the track, starting at the springing lines and working up to crown of both arches simultaneously to avoid any unequal thrust on the centers.

The arch ring concrete was bonded to the portion of the abutment walls previously built by means of rod dowels embedded in the steeped skewbacks formed on the inside of wall (see Fig. 3), in order to provide a foundation for the bents supporting the temporary truss span. The arch ring completed, forms were erected for wing and parapet walls, which were concreted up to the under side of the coping. The coping reinforcement was then placed, the 1:1:2 mixture poured, and the top surface troweled. After the arch centers were removed the 6 in. paving and baffle walls at the ends of the wings were placed.

WATERPROOFING AND FILLING.

When the concrete had thoroughly seasoned and was perfectly dry, a coating of tar pitch was applied to the back of the arch rings, abutments and wings. The filling in of the old trestle was then begun, and then the filling reached the bottom of the temporary truss spanning over the culvert, the second track was laid, the truss was removed, and the fill brought to subgrade by hauling in on the second track. Only the top portion of the timber trestle was salvaged.

QUANTITIES OF MATERIALS.

The falsework for arch barrels required 113,500 board feet of timber, while about 13 tons of reinforcing bars, 75 old 60-lb. rails 33 ft. long, and 2,834 cu. yds. of concrete were required to build the structure. Of the concrete, 1,236 cu. yds. of 1:2:4 mixture were used in the arch rings and walls above springing lines, 1,160 cu. yds. of 1:3:6 mixture in the footings, abutments, pier wall and wings, and 36 cu. yds. of 1:1:2 mixture in the copings. [We are indebted to Mr. E. F. Robinson for plans and data used in this article.]

INTERNATIONAL ENGINEERING CONGRESS

The Materials of Engineering Construction will receive special attention in the proceedings and discussions of the International Engineering Congress to be held in San Francisco, September 20-25 next. The field will be treated under eighteen or more topics, covering: Timber resources; preservative methods; brick and clay products in general; life of concrete structures; aggregates for concrete; water proofing; volume changes in concrete; world's supply of iron; life of iron and steel structures; special steels; status of copper and world's supply; alloy; aluminum; testing of metals of full sized members and of structures.

Some twenty-five papers are expected for this volume, prepared by authors representing five different countries. The list of authors includes many of the most eminent names in this field of engineering work throughout the world. These papers, together with discussions contributed by leading American and foreign engineers, will be published as volume 5 of the transactions, and will be illustrated with charts, diagrams and half tones. The volume will form a most valuable acquisition to the library of all engineers and others who may be interested in these phases of engineering work.

PASSENGER STATION AT SOMERSET, PA.

Carrying out its intention to provide adequate passenger terminal facilities at Somerset, Pa., in keeping with the importance of that city, the Baltimore and Ohio railroad has completed plans for erecting a passenger station which, while affording ample accommodations for travelers, will add to the attractiveness of the city. The new station, 75 ft. long and 30 ft. wide, upon which work will be started at once by the railroad's forces, will be thoroughly modern in design, of brick construction with tapestry effect and a tile roof.

The new station was designed by M. A. Long, architect of the Baltimore & Ohio. The present station will be moved across the tracks and fitted up as a freight station having separate team and house tracks.

The Boston & Albany has placed an order with the American Locomotive Co. to have 10 consolidation (2-8-0) locomotives converted to the Mikado type.

The Glen Rose & Walnut Springs, Walnut Springs, Tex., is in the market for 4 65-ton Mogul type locomotives.

The Middletown & Unionville is in the market for one motor car.

The Mount Airy & Eastern is in the market for a locomotive about 25 tons.

The Pennsylvania Lines West have ordered 25 Consolidation type locomotives from the Lima Locomotive Corporation, and 25 Mikado type locomotives from the Baldwin Locomotive Works.

The Maintenance Labor Problem

A Discussion of the Methods of Obtaining and Handling Laborers on Four Railways

BOSTON & ALBANY

By F. B. FREEMAN,
Chief Engineer

The section foremen on the Boston & Albany hire their laborers themselves and the greater number are obtained from Boston, Worcester, Springfield and Albany. No company labor bureau has been found necessary, as little difficulty is experienced in getting all the men needed.

In the Winter time the forces are cut down to about one-half of the Summer forces. The number is increased on April 1st or shortly after and in July it is decreased somewhat and is down to a Winter basis again about the first of November.

There are few places along this railroad that laborers cannot get board in the surrounding town and country. In some places, however, old passenger coaches are fitted up to accommodate section laborers. Box cars are fitted up for large extra gangs. No particular inducements are offered to laborers to retain them in the employ, except regular time for employment and good pay, as compared with other roads in the territory.

No particular system or method is followed to develop track laborers into foremen. A general supervision is kept over all laborers and when a man is noticed who it is thought would develop into a good man for such a position, he is looked after and given his chance, and it is put up to him to make good. There is no instruction course, but there is an apprentice arrangement in every gang in that the foreman has authority to pay one man more money than the regular wages. The section foreman is obligated to give this position to a man whom he believes can be developed into a future assistant foreman, or foreman. There is no examination before promotion. The supervisor satisfies himself that the man presenting himself for the vacancy is capable of handling the work and under no consideration is a man given the job unless he is considered capable of making good. These methods have been in vogue on this road for about five years and have improved the working conditions of the section foremen over 100 per cent. It is a method which is adapted to a small road like the Boston & Albany and it has brought the section foremen, the better class of section men, the supervisors and the higher officers pretty close together in their interests.

Meetings of the supervisors and the section foremen are held on the various sub-divisions, where they talk over very freely conditions of work, the difficulties which they encounter, each man telling how he overcomes these difficulties; and suggestions are made as to how economies or improvements can be brought about without unnecessary expenditures of money. The whole object is to impress the man in the Maintenance of Way Department with the idea that he is an employee of the road, getting his living by its success and that he cannot get his living if the public is not satisfied. Progress is being made in this work.

The whole success of any organization depends upon the attitude of the men who receive the orders toward the men giving the orders. If there is antagonism it is very difficult to make any arrangements that will produce full results. In other words, this means that you cannot successfully drive men for a continued number of years; you have to lead them—you have to convince them that what is required is the right and proper thing for them to do. This implies also that very careful consideration be given to promotion of men and their development. The character of the men must be carefully studied to see that they are so constituted and that their views are such that they will co-operate in the end in view, which is the highest standard of maintenance at the lowest necessary cost to produce it.

This cannot be accomplished if the supervisor is burdened with a territory so large that he cannot become well acquainted with his foremen, and the tendency in the maintenance departments at present seems toward lack of supervision. A man who has got so much territory to cover and so much to do that he is always tired, cannot give the best results to the people who employ him. In my opinion, his work should be so arranged that he will not be exhausted every night and that he will be able to give some little time and thought to what is going on rather than be struggling all of the time to keep things moving.

I believe that the payment of better rates to section foremen would produce commensurate results. While in some cases it would not immediately produce better men, it would eventually attract more intelligent men to the service for the future, and the future problem is a serious one. In the majority of cases, the pay of track foremen is small as compared to other employments, and therefore the railroads are not getting their share of men who have sufficient intelligence to handle the most important and responsible part of railroad work—that of track maintenance.

NEW YORK CENTRAL

By G. W. VAUGHAN,
Engineer Maintenance of Way

The New York Central R. R. obtains its laborers from New York City, Albany, Utica, Syracuse, Rochester and Buffalo. Every foreman has the privilege of employing his own men direct, but when he cannot secure enough laborers to meet his demands, the men are furnished through private labor agents employed by the company. There are no company labor bureaus and no company men are employed to stay at the private labor agencies to supervise the shipments of men.

Track men are kept permanently employed as far as possible, but it is always found necessary to reduce the force considerably in the Winter. The extra men who are laid off in the Fall are employed part of the time during the Winter months in handling snow.

Alien laborers are provided with bunk houses or cars to live in, but as a rule they furnish their own board. We attempt to keep laborers with us by giving them good treatment and continuous work as far as lies in our power, and promotion and better positions are assured them when they are competent to fill such higher positions and do the work in a satisfactory manner. Our line of promotion is from laborer to section foreman, from section foreman to extra gang foreman, from extra gang foreman to assistant supervisor, and from assistant supervisor to supervisor.

The apprentice system has been developed to some ex-

tent. The usual procedure is to pick out some young bright fellow in the section gang and after he has been thoroughly trained, place him in the position of assistant to the foreman. After he has had the necessary experience in this position, he is either made section foreman, or assistant foreman on an extra gang. Such a man is not required to stay in either position any certain length of time, the promotions simply depending upon when vacancies occur. Examinations on the book of rules are given before promotion. These methods have made the men loyal to the company, by assuring them steady employment and promotion as far as practicable, and this loyalty has increased the reliability of the force as an organization.

THE ROCK ISLAND

By H. G. CLARK,
Assistant to Chief Operating Officer

The Rock Island Lines obtain the greater number of laborers through a labor contractor who has a contract for the entire system and who ships laborers from Chicago, Kansas City, Fort Worth, Memphis, Des Moines, St. Paul, Minneapolis and Omaha.

They endeavor as far as possible to keep trackmen employed the year around, but on account of climatic conditions over a large part of the territory, they are compelled to work very large forces during the Summer months and to cut the forces down during the Winter, except on the Southern lines.

The contractor operates the eating house system and supplies board for all of the extra gangs. They are furnished comfortable bunk cars, properly equipped, and there is a system of inspection which determines whether the board supply is satisfactory in every detail. No special inducements are offered to retain trackmen and no particular method or system is followed in the promotion of track laborers.

There is, however, a track apprentice system, whereby a man is guaranteed work the year around. Apprentices are started at a salary of $45.00 per month, which is later increased to $50.00, and when an apprentice has reached this point, he is considered competent to take care of a section or extra gang, the pay in such positions ranging from $65.00 to $90.00 per month. Roadmasters are obtained from this class of men. They are checked up pretty closely and if they do not prove satisfactory in their work, they are released and another man appointed in their place.

Apprentices are selected from the brightest men obtainable, young engineers and college men sometimes being employed in this capacity. They work under the instruction of a section foreman, take charge of the section accounts and are brought into the roadmaster's office and instructed with regard to the office detail connected with these accounts and any other subjects of this nature. No promotional examinations are held, the men simply being advanced to the position of section foreman when the roadmaster feels they are competent.

There is no question of the value of the apprentice system, but there is some difficulty in getting men of the right caliber interested. On account of the low salaries paid, it is only those who appreciate the value of the experience in their future work and who will work for promotion, not only to the position of section foreman, but to that of roadmaster and still better places, that will remain interested in this work when higher wages are paid in other lines. The full benefit of the apprentice system is therefore not obtained because the salaries at the beginning are low.

There is no chance for an improvement in having the track laborer employed more permanently. One of the principal difficulties in keeping laborers in railroad maintenance work is due to the fact that the men are not employed the year around. The better class therefore seek employment where their positions are more secure. Anything in the way of distributing the work so that stable forces can be worked the entire year, during the Winter as well as the Summer, will improve conditions and I am of the opinion that if this could be done and increased wages paid on a sliding scale dependent upon the length of service, that much better results would be obtained than at the present time.

CHICAGO, ST. PAUL, MINNEAPOLIS & OMAHA

By A. W. TRENHOLM,
General Manager

The Chicago, St. Paul, Minneapolis & Omaha Railway obtains its laborers from Minneapolis, St. Paul, Duluth, Sioux City and Omaha, through private labor agencies and when laborers are scarce an inspector of the Company is placed at the private labor agencies to accept shipments of men. The track forces are reduced in the Winter, the preference being given to men who have been longest in the service, for permanent work.

No special provisions are found necessary in providing living quarters and board for section track laborers. On extra gangs of white men, board is furnished by a contractor at a certain rate per week and the board bill is deducted from the man's pay check. The Company furnishes box cars with bunks, stoves and the contractor furnishes the bedding. The board and bunk facilities have always been satisfactory to the men.

No particular inducements are offered the men to retain them in the Company's employ and no particular system or method is followed in the promotion of track laborers, except in so far as the roadmaster may observe the work of certain laborers and determine whether they are qualified for a position as section foreman.

There is no system of apprentices followed out but laborers being promoted to the position as section foreman must pass written examinations on operating rules pertaining to track work, such as flagging trains, patrolling track during storm, etc.

The fluctuating demand for track laborers and a necessity for economy do not offer much opportunity to effect any form of organization of this class of labor. The season when such men are in demand is short and as soon as harvest season approaches, it is difficult to obtain and hold active men as track laborers, regardless of the wages paid. For regular work, railways must depend largely upon laborers who reside in the small towns along their line.

In view of these facts, it seems hard to make any suggestions for further improvement.

The Maryland Steel Co. has 1 six wheel and five 4 wheel switching locomotives for sale.

The Silver Peak has 2 locomotives for sale.

The Wilkesbarre & Hazleton is in the market for 20 all steel motor cars.

The Baltimore & Ohio has placed an order for 6 box cars from the Mt. Vernon Car Manufacturing Co.

ROADMASTER AND FOREMAN

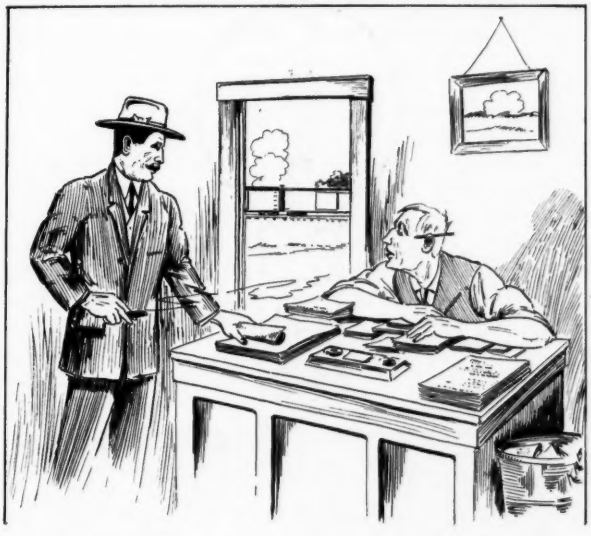
"Good morning," said the R. M. to his clerk, as he stalked into the office Monday morning. "What troubles have the white collars referred to us to-day?"

The elongated clerk shifted uneasily in his chair and directed a stream of tobacco into the spotted mouth of a villainous looking cuspidor, with splendid accuracy.

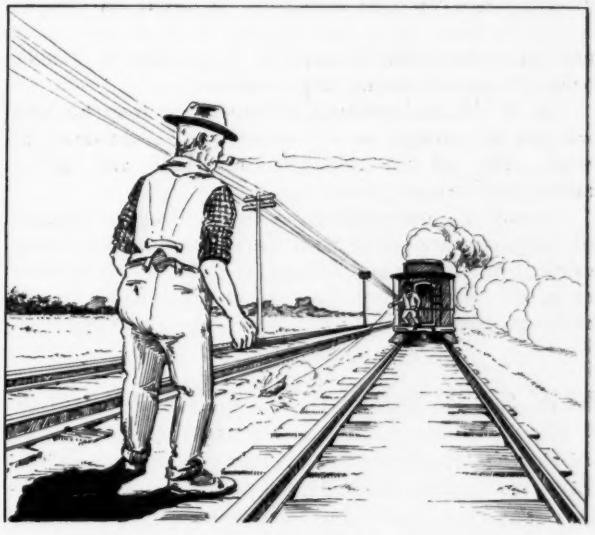
"The Superintendent is kicking again about the weeds on Section 7," said the clerk. "And he says that he saw the end of a crossing plank sticking up at East Liberty; also a couple of boards off the fence at M. P. 63 and is afraid that some stock will get on the track, but of course he don't know that the farmers in that section don't raise stock."

"Did he say anything about that lumber we requisitioned to fix that bad piece of fence?" asked the R. M.

"No," said the clerk as he dug into a pile of papers, "but he says he has turned down our requisition for tie plates for that 6 deg. curve which is giving us trouble and wants to know if you can't reduce your estimate on the gravel and labor for raising the sag in that mud hole between M. P. 86 and 89."



"What Troubles Have the White Collars Referred to Us Today?"



"I Dropped Him a Butterfly Off the Rear End of No. 2"

"Judging from past experience," replied the R. M., "we will receive a scorching letter about using new ties on that curve in about 3 months, but we'll have to replace them if we don't get the tie plates; those ties have only been in two years at that. A wagon wheel won't run long without grease and neither will ties last long without tie plates on that curve. Did he say anything about that switch stand that was knocked clear off the right of way by a hanging Car Door?" continued the R. M.

"Not a word," replied the clerk, "but he did say that Hennessey was a mile and half away from his gang when he went by on No. 6, and wants to know why."

"I suppose that Hennessey had just got around to look at that crossing which was out of line; I dropped him a butterfly off the rear end of No. 2 about 6 hours before that," said the R. M. as he bit the end from a black dangerous looking cigar. "I can't see why it is that some of my oldest foremen persist in waiting till the very last moment before obeying orders. They seem to know just how far they can go with me and they are sure to go the limit. Hennessey hates to leave a job he is working on till it is entirely completed—I almost believe that he would wait to change out two more rotten ties, spike and tamp them up, after getting a message to send out flagmen to protect a mile of track washed out on his section. Some men will never learn to do the most important thing first."

The clerk squirmed in his chair, slapped savagely at a tormenting fly and disgorded a quid of Star which fell with a splash. He dug deeply into a wire basket and pulled out a piece of short form letter-head. "Here's a message for you from the Supt.," said the clerk, with a cadaverous smile. "Says he wants a complete report of the number of ties put in last Tuesday, the cost per tie and why you didn't put in more." The R. M. shot a murderous glance at the caustic request on short form paper, and spat viciously into the corner.

"This gentle message along with the bunch of other things he has asked for will keep me here in the office till it's too late to catch No. 2," he exclaimed, as he looked ruefully at the letter. "The best I can do will probably be to start out here at 3 o'clock and go down as far as Hennessey's section on the motor car."

"Wire Chris and Tony to double up their gangs and get after the weeds on Sect. 7. And wire John the Pollock to beg, borrow or steal a few boards and patch up that fence betwen M. P. 63 and 64. We've got to take the Bull by the horns I suppose, and make the best of it. So he is looking up the cost of putting in ties again is he?" soliliquized the R. M., as he removed his coat and puffed thoughtfully at his La Flor de Knockout as if seeking solace in the clouds of heavy smoke. "They have been checking us up on this cost for so many years that the foremen are all onto the racket. I suppose that all of them are padding their reports to the extent of 2 or 3 ties per man per day, to make sure that the reports will get by. No matter how they have to make out their time books, there is always a chance to charge up several hours each day to raising low joints and general repairs. I hope that some day they will decide to leave this matter of the cost of putting in ties to the roadmaster. If they do, we might be able to get some real information which would assist in bringing some of our poorer foremen up to standard, but as long as they expect twice as much as the men can do,

"This Will Keep Me in the Office Until Too Late to Catch No. 2"

and force them into the habit of lying about it, I don't believe there will be any improvement."

The R. M. had released his innermost thoughts and was too discouraged to say more, so he settled down to work. His tall clerk looked at him sadly and took a monstrous chew of "Star."

Through the open doorway came the fragrant breezes of early summer, laden with the scent of nature's new raiment of fresh green foliage, and the R. M. worked on in the silence which was broken at intervals by the rattle of papers and the humming of telegraph wires.

NEW SECRETARY, N. R. A. ASSOCIATION

Mr. Philip Moore, President of the National Railway Appliances Association, announces the resignation of Bruce V. Crandall, Secretary, effective May 31, 1915.

The announcement states that "the increased demand made upon Mr. Crandall's time by the growth of his own business made it imperative that he decrease the efforts he has heretofore been able to give to affairs of a less personal nature.

"His resignation was considered at a full meeting of the Board on May 21st, and was finally accepted with great regret that he felt the action necessary. The thanks of the association for his valuable services in the past were formally tendered to him by the unanimous vote of the meeting.

"Mr. C. W. Kelly, Treasurer and Director of Exhibits, was elected Secretary for Mr. Crandall's unexpired term, election to be effective June 1, 1915. All correspondence from that date should be addressed to C. W. Kelly, Secretary, National Railway Appliances Association, No. 349 Peoples Gas Building, Chicago.

The Bingham & Garfield is in the market for 50 60-ton Clark extension side dump ore cars.

The Coal & Coke is reported to be building 100 coal cars in its own shops at Gassaway, W. Va.

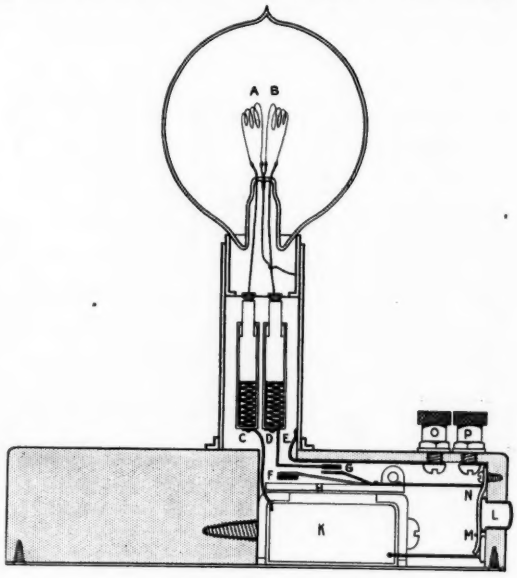
The Glen Rose & Walnut Springs is in the market for prices on 10 passenger and 100 freight cars.

The Illinois Oil Co. of Rock Island is in the market for ten 5,000 gallon tank cars.

MULTIPLE-FILAMENT SIGNAL LAMP

The progress of railway signaling has been always in the direction of dependabiiity—with the elimination of all signal failures as a goal. The signal departments of railroads and the manufacturers of signals and accessories have co-operated to find the source of each cause of failure and to remove any uncertainties which might combine to affect the safety of the signal indication.

In the early development of illuminants for night signals, oil was the only source of light, and fifty years of research has been spent evolving lamp designs—the details of burners, founts, wicks, ventilation, doors, sockets and all the other parts having been studied to evolve a signal lamp which can be relied on in all weathers and under all service conditions. Even the oil used in these lamps has been made a subject of special study and development—and no details have been overlooked which might affect the service of the signal. The receptacles



Double-Filament Signal Lamp Bulb

for storing the oil and the apparatus used in cleaning and filling the lamps also receives careful attention.

The oil lamp may not be perfect—for in a world of progress it is hardly safe to give any production the stamp of finality—but it has been carried as near perfection as seems humanly possible. At any rate, it has been carried nearer perfection than some other elements in the signaling systems of which it plays so important a point.

The coming of electricity as an illuminant found the oil lamp a universally accepted signal standard from which the uncertainties had been eliminated by years of experience. The advantages of electricity as an illuminant in other fields is what eventually led to attempts to carry it into the signal field. These attempts were met with objections on two counts. First, electric current is susceptible to failure from grounds, blown fuses, current or transmission failure. These were more frequent at first than now. It must be conceded that the use of electricity for lighting signal lamps has not been perfected, since it is a fact that even our carefully safeguarded machinery and circuits for house lighting occasionally go wrong. Second, it is impossible to determine

definitely the life of the filament of the lamp. This has been recognized, and in the other fields of illumination it is recommended that when a lamp falls below 80% of its rated candlepower, it shall be replaced by a new lamp, as its length of service is near an end.

Applying these objections to the signaling field, we find them covered to some extent by a rule that when a signal is out, i. e., not picked up, the engineer shall consider such signal failure a stop indication, and shall also report it at the next available opportunity. This rule is vitally necessary in any system which has the human element as one of its working components. But the delays to traffic and the possibility in congested districts of having some other light mistaken for the absent signal, not to mention the possibility of a new engineer overlooking the position of a signal with the light out, indicate that this rule sometimes impedes traffic and does not always safeguard it. This is equally applicable and, in fact, was originally developed to cover the failures of the human element, involved in inspection and refilling. It is almost impossible to entirely protect electric lamps against the failure of current. Fuses protect the lamp, but they are designed to uninterrupt rather than insure the continuity of the current.

The next step in the use of electricity was to develop devices for minimizing the dangers of filament failure. The first of these was to mount the electric attachment (all of the adaptations of electricity to this service have simply involved attachments permitting the use of electricity in standard oil signal lamp bodies) in such a way that in case of failure the old reliable oil fount and burner could be placed in service with as little delay as possible. These attempts resulted in designing the attachments so that they could be readily removed and not interfere with the design of the lamp body for use with an oil burner. Later a model was developed in which the electric attachment and the oil burner were both mounted on a standard oil fount in such a manner that either might be revolved into the optical axis of the lamp.

The idea of mounting two electric lamps on the burner block and connecting them in parallel was next worked out, the design providing that when the first lamp burned out, the second would furnish a more or less satisfactory indication long enough to permit inspection and replacement without actual signal failure. Of course only one of these lamps could be placed at the focal point, and if this lamp failed the one behind or above it would be so far out of focus that it would give very poor illumination.

The difficulties of utilizing electricity for this purpose have not been considered insurmountable, and the latest development along these lines has been achieved by the Adams & Westlake Company. The engineers of this company have experience in signal lamp design that covers the entire period since they were introduced. Their aim in this new signal lamp has been to overcome the undesirable feature mentioned above—the fact that only one of these could be in focus on the lens. The design illustrated herewith is an electric lamp containing two independent filaments with three contacts on the base of the lamp, arranged in such a manner that current can be supplied independently to either. These filaments are wound spirally and occupy a space of only one-half an inch in any direction, which is about the area covered by a flat-flame long-time burner, and which may be considered the standard on which the designs of our present signal lenses are based.

The operation of this lamp can best be understood by reference to the illustration. The current is introduced at the binding posts O and P. O is direct connected to the shell of the lamp socket and through this to the common terminal of the two lamp filaments A and B. P is connected through the contact spring M with the relay magnet K, through this to socket terminal C, and thence completes the circuit through filament A. The relay K being energized, holds its armature H with sufficient strength to overcome the tension of spring F and prevent contact at G. When in natural course filament A fails, this circuit is broken and relay K is no longer magnetized. Spring F at once completes at G a second circuit P-N-G-D-B-E-O, which includes the unburned filament B. The emergency filament instantly lights up and can reasonably be expected to burn until inspection reveals the failure of filament A.

A necessary inspection feature has been provided. By pressing the button L, a break in the circuit P-M-K-C-A-E-O is effected at M, giving the same operating effect as a failure of filament A and causing the current to jump to filament B. If there is no change when the inspector presses the button, there must already be a break in the circuit through filament A. The lamp must then be burning on the reserve filament B and should be replaced at once. The block is the size of a standard oil fount and the socket of such height that the lamp is accurately in focus, with respect to the lens. This development is a step in the right direction and would seem to overcome the danger of filament failure in using electricity as a signal illuminant. However, it must not be regarded as solving all of the problems, as there is still the difficulty that interruptions in illuminating current must cause a failure of the signal light.

This failure of current is serious enough if at a single, battery fed signal. In a. c. signaling, failure of the transmission current would cause the failure of all the lights in a section. With oil lighting, each lamp is its own power station and the failure of one light will in no way disturb the balance of the signal system.

CONCRETE REPAIRS TO WOOD POLES

The Union Traction Co., of Indiana, has reinforced many wooden trolley poles along its lines at an average cost of $2.00 per pole. After shaving off the rotted portion at the ground line, a heavy coat of creosote was applied, and a circular sheet metal form 4 ft. long, built in two pieces so as to give a diameter of from 18 to 24 inches was placed about the pole. A strip of woven wire fabric with a 3 x 4-inch mesh was wrapped around the pole and the concrete applied. This treatment stops the rotting of poles at the ground line, restores them to their former strength and very materially prolongs their life.

The Pennsylvania Railroad has placed an order for 7,643 freight cars, divided as follows: Cambria Steel Co., 300 box and 3,000 hopper cars; American Car & Foundry Co., 224 refrigerator, 1,000 gondola, 1,719 hopper and 400 all-steel box cars; Pressed Steel Car Co., 500 gondola and 300 box cars; Standard Steel Car Co., 200 hopper cars.

The Washington, Baltimore & Annapolis Electric has purchased 5 all-steel straight passenger coaches from the Cincinnati Car Co.

STEEL FOR RAILROAD STRUCTURES

By A. W. HOFFMANN, *Assoc. M. Am. Soc. C. E.*

Steel is essentially a material for superstructures, and a study of the adaptability of steel may at the outset be limited to this subject. As a matter of fact, steel has been used for railroad bridge superstructures for such a long time that its adaptability cannot well be questioned. It is, however, a question for just what types of structures, steel can be used to the greatest advantage, both from the viewpoint of good engineering and of economy. For a proper understanding of the adaptability of structural steel it is convenient to distinguish first, the class of superstructures exclusively reserved for steel, second the class of superstructures for which steel is competing with other materials, chiefly reinforced concrete, and finally new or undeveloped types of superstructures for which steel might be advantageously used.

Structural steel is practically the only available material for long span bridges. A number of concrete arch bridges of approximately 300 ft. span have been built, but for spans above 300 ft. the field is clear and the majority of railroad superstructures of 100 ft. to 300 ft. span are now, and future structures of these spans will probably be steel. The reason for the predominance of steel for long-span railroad bridges is the light weight and the allowable high unit stresses, as compared with any kind of masonry construction. The dead load of long span masonry superstructures increases so rapidly with increasing span that the limit of practicability is soon reached. It should be noted that long-span masonry bridges for railroad purposes are arch bridges which can by proper selections of the shape, be so designed as to eliminate practically all stresses other than direct compression. The economical span of masonry superstructures based on the principle of the beam is much shorter than that of the arch owing to the heavy shearing forces at the end, and the bending moments which cause compression and tension in the top and bottom fibres respectively; yet, it is hard to say, what is the ultimate economical limit of masonry girder bridge spans. In recent years, reinforced concrete trusses of various types have been built for long spans, and it remains to be seen where the new development will end. In the meantime it is safe to say that railroad superstructures, based on the principle of the beam, of more than 100 ft. span, are almost exclusively left to the steel engineer to design.

It is not proposed to discuss at any length the types of steel superstructures for long span railroad bridges. For spans of about and not much in excess of 100 ft. the plate girder dominates. The plate girder bridge is a much favored type because of its simple details and because the shop work is inexpensive. As a general rule, however, more material is required for a plate girder than for a truss of the same span, unless the depth of both types is restricted so much that the solid web weighs less than the web members of the truss and their connections to the flanges. For unrestricted depth, however, the truss is lighter than the plate girder, and it requires a special study in each case to determine the saving in weight which will just offset the increased shop cost. Ease of erection, transportation charges, etc., should, of course, be considered in estimating the relative economy of each type.

Plate girders of more than 120 ft. are very rarely found. For such spans the truss is the only solution wherever a girder bridge is desired. The advantages and disadvantages of pin-connected and riveted trusses will not be discussed here. It may be sufficient to mention the possibilities for improvement of the design of compression members, based on recent experiments with different types of column bracings. Another significant feature is the growing popularity of riveted trusses. This can be interpreted to mean that the secondary stresses produced by the rigid connection of the members at the joints are no longer feared. It is but a short step from the acceptance of secondary stresses in a truss which are very difficult to analyze, to the voluntary adoption of statically undeterminate types of trusses, the stresses in which are more readily analyzed.

The knowledge of the theory and design of the simpler forms of statically indeterminate structures is no longer held by but a few engineers. At the present time these problems can be solved by a large number of competent designing engineers. As a general rule, the statically indeterminate trusses involve less material than the simple girders of the same spans. And they should, therefore, in any case be taken into consideration and given sufficient study to determine their economy and other possible advantages.

The development of steel arches for railroad bridges and viaducts has not been marked by the same success as that of the truss. Only a relatively small number of long-span steel arches for railroad bridges are in existence, although there is undoubtedly a great field for this type as has been demonstrated by the success of the long-span concrete arch bridges. Wherever the foundation is suitable for a concrete arch, it is good enough for a steel arch, and simple methods of erection might in some cases cause a decision in favor of structural steel. Whereas concrete designing engineers, as a rule, are carefully studying local conditions before deciding what type of structure should be used, the steel designing engineers should be blamed for being more inclined to apply standard layouts to local conditions whether they fit well or not.

When timber trestles are to be replaced by permanent steel viaducts, the towers and intermediate spans of the viaduct are often laid out to fit standard spans and so as not to interfere with the timber bents, regardless of where the pedestals are located. This practice sometimes leads to unnecessarily high towers, or to pedestals or other bents being located in the stream, thereby causing excessive expense for excavation and towers. A well arranged steel arch of moderate span avoiding the deepest portions of the ravine, will often result in great economy over a standard trestle, and can also be so designed as to minimize interference with the timber trestles. In this respect, it is recommended that a careful study of the best layout be made in each individual case, like the concrete engineers would make by force of training and habit.

This consideration applies also to the class of structures for which both structural steel or reinforced concrete can be used, with no considerable difference in cost. Steel-bridge superstructures of moderate span will be found economical especially where heavy loads are to be carried. There is no great variety, the most important being the plate-girder bridge structural type for moderate spans, and except for minor details, the main features of the design can be taken out of tables and standards, for certain spans and loads. It is in this field that the growing competition of reinforced concrete is

most keenly felt, owing to the originality of several new types of concrete structures. It remains to be seen whether by improved methods of plate-girder design and shop practice, a higher degree of economy can be attained. It is the object of structural-steel engineering, not only to improve methods of design and construction of types which are in common use, but also to devise new methods for extending the field of application. Careful study will show, for example, the advantages of structural steel for bridges of extremely low depths. This feature is of great importance for city grade separation work.

A great field for structural steel can profitably be developed by systematizing steel centering for concrete arches, and also by recommending wherever possible the use of structural-steel framing for reinforcing concrete. The Melan arches are an example of this type of structural. It is, however, apparent that similar principles could be applied to other types of reinforced-concrete structures. This would be highly desirable for railroad work where it is sometimes difficult to build centering and forms without interfering with railroad or street clearances. In such cases forms may be hung from light steel framing, and construction simplified accordingly.

Structural steel will always remain popular for railroad work because a steel superstructure can, if the substructure is substantial enough, be easily replaced by a new heavier structure when such is required for heavier traffic, or when damage is done by other causes.

LIFT BRIDGES, DELRAY CONNECTING R. R.

The Solvay Process Company, in conjunction with its general improvements on the Delray Connecting R. R., a concern subsidiary to the large Detroit plant, found it advisable to replace a center pier swing bridge over the River Rouge, with two rolling lift bridges to facilitate the increasing traffic between the plant and the railway yard. The Government requires a 120 ft. clear opening between fenders on this river, and as the two bridges were to be within 150 ft. of each other, the two single-track rolling lift bridges were built at diverging angles from the south bank.

The east bridge forms an angle of 44 deg. 11½ min. to fender line, and has a movable span of 210 ft., a track girder span of 40 ft. on the south bank, and an approach span of 20 ft. on the north end. The west bridge was built at an angle of 75 deg. 25½ min. to the fender line, and has a movable span of 141 ft., a track girder span on the south of 34 ft. and an approach girder span of 20 ft. at the north end. Both bridges are designed under the A. R. E. A. general specifications for Cooper's loading.

In addition to carrying the railway traffic, the short span is a highway bridge, and has 4 ft. sidewalks, which are carried on brackets on the outside of the trusses. This gives a roadway of 15 ft. between curbs and 26 ft. 5 in. between sidewalk railings. The movable span is of the Warren, through-truss type, 16 ft. 3 in. center to center of trusses, with parallel chords 29 ft. center to center. The span is equipped with an a. c. 37 h. p. motor, and means are also provided for operating by hand, when desired. The span operates through an angle of 81 deg. 10 min. The 210 ft. span is of the same general design as the short span, but it is strictly a railway bridge, having trusses 18 ft. center to center, and a sloping top chord. The bridge is operated through an angle of 76 deg. 23 min. and is equipped with two a. c. 30 h. p. motors. Means for operating by hand are provided.

Both bridges are operated from one house, which is supported on brackets on the west side of the track girder span of the long bridge. Each has a separate control, and one operator can operate both at one time, or either separately, as desired. Rapid progress was made in erecting these bridges. On the 210 ft. bridge the first steel was raised on May 20th, erection was completed on July 19th, the bridge was operated on July 27th, and on August 15th it was opened to traffic. On the 141 ft. span erection was started on October 6th, and was completed on November 7th; the bridge was operated November 14th, and it was opened to traffic on December 3, 1914.

Two Rolling-Lift Bridges on the Delray Connecting

The efficiency of the forces is indicated by the short time involved in the work, and the fact that no one was injured during construction. The type of structure, too, lends itself readily to rapid erection.

The Scherzer Rolling Lift Bridge Company, Monadnock building, Chicago, furnished the designs, plans and specifications of the superstructure, operating machinery and power equipment for both of these bridges, and also maintained a consulting engineering supervision during the manufacture and erection. The engineering department of the Solvay Process Company designed the substructures. The Pennsylvania Steel Company manufactured and erected the superstructures of both bridges. Messrs. Ginzel & Towler, of Detroit, were the contractors for the substructures.

The Northern Pacific is in the market for 750 center sills and 750 sets of draft gears.

The Mount Airy & Eastern is in the market for logging cars.

The Nevada Northern is said to be in the market for 100 dump cars.

The New York Ontario & Western is inquiring for 20 caboose underframes.

The Pennsylvania Railroad is reported to be inquiring for about 750 tons of steel for various small bridges.

PORTABLE CONCRETE RAILWAY BUILDINGS

By A. M. Wolf, C. E.

Within the last few years the idea of building concrete structures in units which can be conveniently handled, and then transporting them to the site, has rapidly gained in popularity and has resulted in much economic construction in places where the conditions are unfavorable for depositing the concrete in situ. For the same reason it has been found very economical to build small monolithic, reinforced-concrete buildings such as are used in railway work for oil houses, tool houses, switchmens' cabins, telephone booths, waiting rooms and shelters, so as to be readily transportable from the central plant to any desired site, or from one place to another as the occasion demands. Many buildings of such a nature have been built and used, the only limitation other than weight being that when loaded on cars, they must conform to the standard railroad clearance; this limits the width to 9 feet.

GENERAL

The C. F. Massey Co. has built a large number of reinforced-concrete portable houses of various shapes for railroad use. The houses shown in the accompanying illustrations are made in several shapes; viz., hexagonal for 4 ft. houses, and octagonal up to 8 ft. width across flats, while larger houses are made rectangular in plan and in general of two sizes, 8 ft. x 10 ft. and 9 ft. x 13 ft. The width of structures which are to be transported on cars is limited to 9 ft., but they can be built as long as desired without hampering the easy handling and portability of the structure.

These houses have a 7 ft. 4 in. space to ceiling and a reinforced concrete floor, 4 in. thick, raised 4 in. above the bottom of sill to form an air space under the floor. The exterior walls are 3½ in. thick, except where recessed panels occur, in which case the thickness is decreased to 2½ in. These panels decrease the weight of the building and enhance the appearance. The exterior surfaces are finished by a special waterproofing process, which prevents hair cracking, makes the house entirely weatherproof and leaves the natural gray color of the cement. The interiors are painted with a special acid-proof white paint. Ordinarily the houses are equipped with wood doors, sash and trim, but when a fireproof structure is desired metal doors, sash and trim are used, the sash being glazed with plain and wire glass.

HEXAGONAL AND OCTAGONAL HOUSES

The hexagonal and octagonal houses are used for telephone booths, oil houses, watchmen's shelters and way stations. The 4 ft. diameter houses are mainly for telephone booths (see Fig. 1), are hexagonal in plan and weigh about 2 tons. Houses of 5½ ft. to 8 ft. diameter are made octagonal and have a weight of from 2½ to 5 tons. In Fig. 2 is shown a 5 ft. 6 in. diameter house generally used for oil storage. These houses are equipped with storage tanks and all necessary piping and pump for pumping oil into or out of the tanks, a sleeve being set in the wall through which a flexible hose is run to connect the pump with a tank car or barrels. Where the storing of small quantities of oil is necessary these structures give excellent service, a saving in oil being effected over the usual methods of storing in barrels, in wooden buildings and the insurance rates on adjoining buildings are lowered on account of the fire-proof character of the concrete house. In Fig. 3 is shown an 8 ft. octagonal house which is used extensively for way stations, the interior being well lighted by several windows.

Fig. 1—Concrete Telephone Booth

Fig. 2—Concrete Oil Storage House

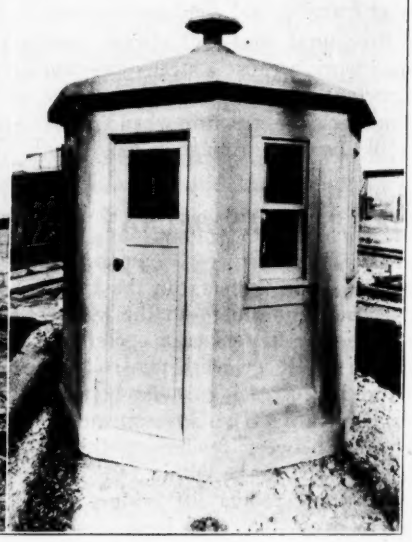


Fig. 3—Monolithic Octagonal Way Station House

These houses are poured in metal forms; no top forms are used on the roofs, the surface being given a troweled finish. The reinforcement consists of ¾ in. diameter vertical bars at corners bent into the floor slab, carried up in the roof slab, and hooked at the top around a ring, around the ventilator opening. Horizonal bars (⅜ in.) at 1 ft. spacing are used, and in addition an electrically welded wire fabric is stretched over the main bars.

The ventilators, which can also be used as smoke vents, are cast in one piece in a mould and set into the openings left for them in the roof. These openings are used in handling the houses, a chain from a derrick or crane being dropped through and fastened to a timber placed across the inside of roof.

RECTANGULAR HOUSES

The rectangular buildings are being used only for stations, power houses, tool sheds and oil houses at present, but there is no reason why their use cannot be extended. They are built monolithic in sectional metal forms, with paneled sides and a cornice formed in cast-iron molds set on the top of the sheet metal forms. The reinforcement is a network of ⅜ in. round and ½ in. square bars spaced about 1 ft. centers horizontally and vertically, over which a welded wire fabric is stretched. The vertical rods are bent into the floor and roof slabs, and are hooked around a ridge bar, thus completely tying the structure together. The floor construction is of the same character as for smaller houses, and the houses are equipped with windows and doors of either steel or wood as desired.

Buildings suitable in size for use as hand-car and section houses are designed and built in units, shipped knocked down, and as they consist of simple slab units they are readily erected by any section crew.

COMMENT

The two-car shipment of monolithic concrete products shown in Fig. 5 is an interesting illustration of the wide field covered by this industry. The shipment includes rectangular and octagonal houses, battery boxes and culvert pipe.

The railroads are rapidly recognizing the great economies which can be effected by the use of small fire-proof buildings for the many purposes and uses to which mainly wooden buildings have in the past been put. Fire losses on such structures, although in each individual case they may be insignificant, reach a large total and the portable concrete house is sure to find great favor since the fire losses are reduced to practically nothing.

Other advantages of concrete houses are that they are more sanitary and weatherproof than wood and not subject to wanton disfiguration and marring by the "wielder of the jack-knife."

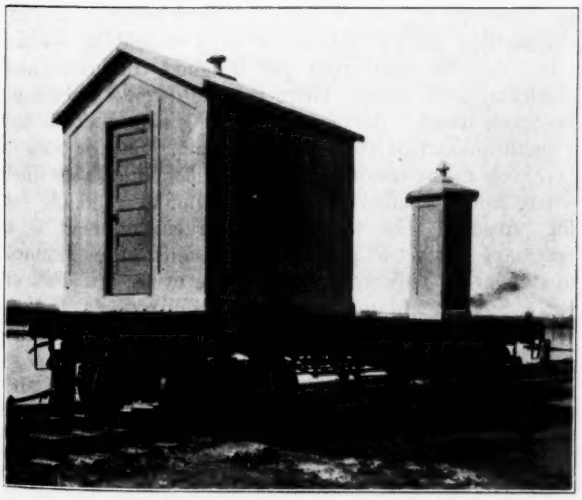


Fig. 4—Monolithic Rectangular Station House Ready for Shipment

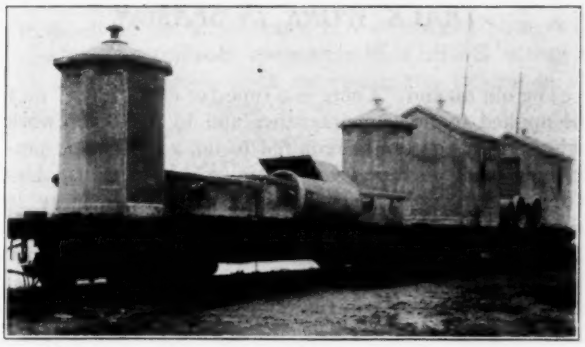


Fig. 5—A Shipment of Portable Concrete Houses and Other Factory-Made Concrete Products

The writer is indebted to the C. F. Massey Co. of Chicago for the photographs and data used herein.

PROGRESS ON UNION DEPOT

The contract has been let for the construction of the foundations of the new freight houses to be built at Chicago, in connection with the new Union Terminal. This work involves 45,000 cubic yards of concrete, 20,000 lineal feet of piling and 50,000 cubic yards of excavation. A contract has also been let for the building of reinforced concrete and brick sewers and curb and retaining walls in Canal, Monroe and Clinton streets.

APROPOS THE EDISON FIRE

Mr. Thomas A. Edison has handed the "brick interests" a very deserving "slap" on account of the mis-statements published broadcast in the "clay organs" regarding the alleged destruction of concrete buildings during the disastrous fire of Dec. 9 at the Orange, N. J., plant. In a letter to the technical press Mr. Edison states in part, the following.

"Every brick and steel building which was attacked by the fire was completely destroyed, together with all the machinery they contained while the damage done to the concrete building amounted to about 12½%; of the machinery contained in the concrete buildings 98% was saved and is now in operation. Manufacturing was resumed in some of the old concrete buildings within a few weeks after the date of the fire. Temperatures were far in excess of those in the ordinary fire, but reinforced concrete showed its superiority over any other fire-resisting material.

"I regret that any representative of the brick interests should have seen fit to sponsor this publication, the evident purpose of which is to deceive. The millions of dollars of fire losses in this country annually make it a matter of moment that the superiority of reinforced concrete for fireproof construction should be thoroughly understood, and it is for such purpose that this letter is written."

Mr. Edison's statement leaves nothing to be said.

Bids will be received until noon, June 10, for constructing 38-mile railway from railroad at Gila Bend south to a point near Ajo. John C. Greenway, Warren, Ariz., is General Manager. R. H. Jones, Gila Bend, is Chief Engineer.

The Gary, Hobart & Eastern is considering extending its tracks in Gary from Broadway east to Virginia St. and north to the mill gates.

TRACK WORK IN SEASON

By P. J. McAndrews, Roadmaster*

The old maxim, "There is a time for everything," may be applied to track maintenance and to the other work which track forces are required to do, a systematic procedure being advantageous from any viewpoint. Unfortunately, our managements have great difficulty in times of business depression in carrying out their desires in this important line of activity, work being postponed and carried over from year to year to the detriment of the property, and contributing indirectly to increased costs at a later date to bring the work up to the required standard. Thus, failure or inability to employ sufficient regular or section track forces leads to the employment of extra and floating gangs during good years to make up for the deficiency of labor in the lean years.

Maintenance of track means renewal of ties to a more or less extent yearly, and at the proper time of the year, renewal of rails at periods of time depending on the density of traffic, curvature, etc., while the maintaining of fences, which on many roads is handled by track forces, and regular policing of track, must all be done at proper times. The use of extra gangs for extensive renewals of rail and the application of new ballast out of a face are a necessity, but the employment of such gangs in ordinary maintenance ought to be avoided and may be avoided if section forces are assigned in suitable number and at the proper season. In the temperate zone, which includes a greater portion of this country, we believe that a plan of work somewhat as outlined herein would prove suitable on most lines.

Spring Work—When frost is leaving the ground, especially in light ballasted or poorly drained districts, the track is liable to develop uneven and bad riding conditions, which until frost is entirely out must be taken care of by shimming. When the frost is out of the ground we usually find that some attention must be given to smoothing up rough spots and this will take some time during the first half of April; forces at this season should be increased a reasonable number, depending, of course, on local conditions. General surfacing of track is not advisable until frost is all out and track "settled" by Spring rains. Rubbish or earth should be removed from small waterways to permit of free drainage, shims that may have been applied during the Winter to correct uneven surface must be removed and ties tamped after surfacing the track.

The Spring is the proper time for making tie renewals, and after giving necessary attention to leveling and lining track the renewals should be undertaken and continued until complete, only such stretches of track being excepted as may be included in the season's program for rail renewal or reballasting. Track bolts needing to be tightened should be looked after during the Spring, the season of medium temperature and days not too hot or too cold being the most suitable time for the tightening of track bolts.

Approaches to highway crossings usually need some attention at this time, and where track forces maintain the planking in crossing, worn planks should be renewed and the whole put in good condition. With the extensive use of automobiles, crossings need be maintained to a high standard. This will silence criticism and create a more friendly feeling on the part of the public.

Summer Work—During the month of June it is necessary to mow the right-of-way in some districts, this being especially so in states having weed laws, which carry a penalty for failure of property owners to kill noxious weeds at stated times (the railways being the particular victims of such laws). Aside from this, a neat appearing right-of-way results from the mowing of weeds and their spreading will be prevented if cut before seeding. Track weeds also must be cut in June or in some seasons earlier on light ballasted lines using gravel or earth ballast, this work taking considerable time. Killing of track weeds and vegetation close to track is now being successfully done by the use of chemicals sprinkled on the track from tank cars, this method appearing so economical that hand labor ought not be used.

If necessary to turn or replace any angle bars, the early summer season is a good time to do the work, the spacing of ties and proper surfacing of track being carried on in connection with it. Right-of-way should be mowed over entirely during the month of July in most states, and not later than August in any case, it being important to do this work before vegetation toughens, as that renders the work more difficult and expensive.

The time not expended in weeding, turning angle bars, etc., after tie renewals are made, must be utilized to surface and maintain track in the required riding condition.

Fall Work—The early Fall should be devoted to surfacing, lining and general improving of track. In light ballast, and especially in territory subject to heavy Fall rains, late surfacing and disturbance of ballast is not advisable, August and September being most desirable for giving the track a last light surfacing and smoothing up. On stone ballast, when not foul, surfacing may be done without detriment until frost. Track bolts should be given constant attention, but it will be found advisable to look them over during September, tightening such as need it before cold weather sets in.

Before ground freezes enough to prevent handling of material, ditches and waterways should be carefully inspected and the vegetation and rubbish cleaned out to give free movement of water that usually flows during the thaws of late Winter and early Spring. Drainage is an essential to good track which must be given deserved attention.

When ballast freezes, and before snowfall if possible, any necessary regaging of track ought to be taken care of. On sections having sidetracks, they should be looked after, switches and frogs put in good condition, and incidental work done. There is quite often a stretch of favorable weather during the late Fall when there is but a small amount of frost in the ground. Such a time is favorable to the restoring of weak embankments on lines where ashes or other material may not be available for the purpose. The shoulder on an embankment is a necessary adjunct of good track and must be maintained to standard. This work can be done in the late Fall or early Spring. Many companies require their section forces to maintain right-of-way fences, and a considerable amount of this work may often be accomplished in the period after surfacing of track is discontinued and before the ground freezes solid or heavy snow falls. Where stretches of fence need rebuilding or where much new fence is to be built, we believe the organization of a separate fence gang is more economical than the use of trackmen for such work.

* President, Roadmasters' and Maintenance of Way Association.

General—The program of a season's rail renewals and reballasting is of great importance and it has been proven that new main track rail may be economically handled in Winter, thus having a few gangs accomplish a large amount of rail laying in advance, wiping it off the slate and having the new material in track ready for surfacing early in Spring. Sidetrack rail needing renewal should always be taken care of during the Winter. Ballasting should be started early in the Spring, thus giving the track time to settle and rough spots to show up so they can be taken care of at the proper time. An "all-the-year-round program" of work may mean expenditures in months heretofore considered as light maintenance months, but such a plan does away with the abnormal demand for labor, the annual increase in trackmen's rate of pay, and increases the efficiency of a track maintenance organization.

The employment of regular forces early in Spring and retaining them in the service more uniformly as an all-year-round force, does away with the employment of extra and floating gangs for ordinary maintenance work and tends to make for more settled labor conditions.

TRACK MAINTENANCE PROGRAM

By an Engineer

Our methods of arranging track work vary greatly on account of the extremes in climatic conditions from Winter to Summer. The first thing to do in the Spring after the frost has left the ground is to take care of the waterways, cleaning them out thoroughly and then to get started in renewing ties.

In locations where there is frost in the ground and heaving track must be contended with, the shims have to be removed and also the snow must be removed from waterways. After the snow and ice disappear, there should be a general cleaning up of station and all other company building grounds. The scraps should be picked up and piled in the proper places and all such work done. After the frost is out of the ground the forces should be increased for the purpose of putting in ties, and after they are all in, the track is overhauled wherever necessary; this includes lining, surfacing, leveling, tightening bolts, driving spikes snug against the rail, etc.

In the Summer the weeds and grass must be cut and this work usually lasts well into the Fall, when preparations are made for the Winter months. Portable snow fences must be erected and permanent snow fences repaired wherever snow troubles are likely to be encountered. The ballast should be cleaned out from under and around switch points, guard rails, frogs, etc., so as to provide space for the snow to fall where it can be easily shoveled out and thus permit the points to be kept free so that they can move. The weeds and grass should be cleaned out of ditches and also from under and around all structures. The right-of-way should be cut and burned off, first establishing fire guards so as to avoid damage to adjoining property.

After this work is done the forces are reduced to a Winter basis according to the conditions and circumstances. Naturally, it is not necessary or advisable to reduce the force to a great extent where the ground does not ever freeze. There are a great many minor details, such as distributing ties, repairing fences and crossings, changing outrails, joint fastenings, tie plates, etc.—things which are too numerous to mention in a general outline. But I have found it to be the most economical practice to do all the work mentioned herein in season; otherwise one part of the work crowds another in such a way as to make the whole work expensive and lacking in the results which should be shown.

SEASONAL TRACK WORK

By Chris Clay

Since January 1st bears no relation to track work, in a resumé of the average year's work we should start with Spring. During the prior year we have looked over the division or district and have made our requisitions for the material that will be required, so that if the appropriations are made we should by Spring have the material on the ground. If there is ten miles of rail to lay and the territory is ballasted so that there is merely patch work on it, the number of gangs required for the rail should be figured and extra foremen examined and instructed to be ready to take the place of those who will be promoted to extra gangs.

It should be ascertained whether laborers can be had in the neighborhood, or whether they will have to be imported, and arrangements made accordingly. The tools that will be needed, and in fact every requisite for the gangs, should be on the ground before the actual opening of work so that there can be no delay. If possible, a supply of ties should be distributed so as to be ready as soon as the weather opens up. With the extra gangs arranged for, attention can be turned to the sections. If the Spring rains are not too heavy in the locality, the ditching done at the time will be negligible. The major portion of the work done in the Spring should be surfacing and inserting ties, as later other matters claim attention. I have seen men let this work slide, and other matters come up so that it was pushed ahead until the following Spring, the gang doing work that could have been done better at some other time. If there is a lot of surfacing to be done on a division, it is preferable to put on a small extra gang in the Spring and let them help out the sections. However, this is a matter that has had a great deal of discussion and it is a disputed point as to whether the section forces should be augmented or an extra gang set to work, this being a matter of preference and to a great extent dependent on local labor conditions. But certain it is, that whatever method is used, as much of the surfacing and putting in of ties as possible should be done in the Spring.

In the Summer, forces are usually low because there are so many other industries that claim the men. Therefore, if the Spring has been taken advantage of, the track is not so insistent for work on it. At this season it is time to start on the weeds, and they claim a great deal of attention. Where they can be cut by contract or the right-of-way will permit the use of a machine, our track work may be continued, but in the majority of cases we have to be content with spotting up and giving the major portion of the time to the weeds. Later in the Summer, especially if there are heavy Fall rains in the locality, as much ditching as possible should be done. If the work warrants, an extra gang can be used for the purpose and relieve the sections of the work.

This work will generally last till Fall, when it is necessary to get the track in the best shape to go through the Winter. If there are any ties still on hand these should be put in as soon as possible. Track should be surfaced

and ditching completed. To be explicit, the track should be given all the time that is possible.

Usually the Winter arrives before things are quite ready, as there is so much to be done; labor is scarce, and there is so little to do it with. However, if the weather continues open quite a lot of work can be done during the major portion of the day before the cold weather sets in. If there are tie plates to be inserted or work of such nature, owing to the material not having arrived before, this can be done to advantage now. But the most of the work in the Winter time will be going over the fences so that they will not bother us in the Summer, tightening bolts, driving spikes and work of such nature. Ballast, if any other than dirt, might be dressed.

One cannot give a general treatise on the matter because a great deal of the work is dependent on the arrival of the material. However, such work as outlined is with us all the time. The early Winter is as good a time as any to figure on what material will be required, so that arrangements can be made to have this on hand for the Spring. Generally about June the supplementary estimates go in, and these can be checked up and the definite location of the material settled. One piece of work will be dependent on another; for instance, to change the rail on curves it may be necessary to wait for rail relieved on tangents being replaced by heavier rail elsewhere. New rail may arrive in mid-Winter, as well as mid-Summer, so that little figuring can be done on the extraordinary repairs. Then, too, there may be a monetary trouble, and though the material is at hand, orders may be given not to use it.

But if location and quantity are definitely settled in the Winter, it is easier to adjust such quantities as are received to the necessities of the individual section. Whether it is advantageous to fix up one man first and give him a larger number of men is a debatable point. When the material is received in small quantities it would seem preferable to give each man a little and let him use it. Both methods are in vogue. Foremen communicate with each other, so that where one man is given all under the circumstances quoted, with the intention of giving another the major portion of the later receipts, this man as apt to say nothing but feel that he has been slighted, and his work is apt to fall off a little, but not enough to justify discipline; and later he is hindered by the work that has not be done.

If the material is on the ground ready for the Spring work, it is well to get as much of the track work as possible out of the way, as the other seasons bring troubles of their own. With an early start one can meet the troubles of washouts, weeds and other matters to better advantage when they show up.

Promotion work is under way for a railroad from Ingleside, Ark., to Fisher, to be known as The Ingleside & East Arkansas. S. B. Richmond, St. Louis, Mo., is interested.

Bids will be received until May 28, by L. K. Jones, Assistant Deputy Minister Railways and Canals, Ottawa, Ont., for 2-mile spur line from main line of Intercolonial Ry. about 1.8 miles from Bathhurst.

Nevada Short Line has just started construction on a 12 to 14 mile extension from Nenzel station on the Southern Pacific to the gold and silver mines at Rochester, Nev.

REMEDYING SLIDES AND SINK HOLES

By D. C. Davis

I had some experience with a slide in Kansas about 1885, where the railway was laid on the side of a hill, necessitating a cut from 3 to 10 ft. deep. From the beginning an extra lot of cleaning was necessary on the track ditch, in order to keep the upper side properly drained, and the banks gradually encroached on the track so that finally an investigation was made. It developed that the entire hill side, timber and all, was gradually sliding down, and that if not stopped in some way the road would soon have to be abandoned.

The engineers devised a plan for taking care of this trouble and dug four ditches about 100 ft. apart, down to the solid formation, parallel with the track. Another series of ditches was dug about 250 ft. apart perpendicular to the track; these ditches were located where it appeared the most water had concentrated. This slide was checked and has never given any further trouble, but it was an expensive method.

At another point, in a rough hilly section, a side cut was located which had a bottom on a sloping layer of soap stone. Whenever there was a heavy rain the surface would fall off at the edge and it soon became so bad that it was necessary to keep a watchman there continually. And it frequently required a work train and all the section men to keep the track open. After a heavy slide that stopped traffic for 15 hours, it was decided best to remove the entire surface of dirt and stone and a gang was put to work and retained until the surface dirt was removed to the top of the hill. This expensive work could have been prevented by cutting a parallel ditch back of the right of way line, deep enough to have caught and carried the seeping water away.

Pockets in railway grades are caused by throwing out the mud which comes up between the ties and putting ballast under in its place. Every shovel full of dirt which is thrown out simply increases the water capacity of the basin under the track. There should never be a place left in the roadbed under the track that is lower than the outside of the grade. I know of one place where a cut was taken out down to within about three ft. of soap stone, and the track being located on clay never held up well. Orders were given to the section men to throw out the mud and put in cinders. This method was followed into until an immense amount of cinders had been put in and the capacity for water under the track was simply increased. No permanent relief was effected until drain tiles were put in. Had these places been raised on dirt, and properly drained, the water would never have laid long enough in one place to have produced a soft pocket.

I raised a place over 400 ft. long which was hardly passable for trains, using the mud from the ends and shoulders and also from the ditch and putting it under the ties. After raising it about 12 to 18 inches the ditches were cleaned out and a good waterway provided, and this entirely eliminated any further trouble.

There are places where the side of an embankment will break off and let the track down and out of line, and no reason is apparent. After investigating a large number of such places I found that water had started a long ways back of the point where the grade broke off and had formed a sort of a channel running along under the track in the ballast, and finally breaking out where the grade changed from descending to ascending. This

defect can be remedied by beginning back on the grade at the point where the water starts to collect and putting in a cross drain. The ditch should be made as narrow as men can work in, and dug down just a little below the earth top. It should be shaped so that any water coming down the center of the track would be carried out each way and these ditches should be filled with clean coarse gravel. Then other cross ditches are put in about 100 ft. apart and will soon dry out the fills. In some cases this will not effect as rapid improvement as desired and a narrow ditch with tiling, or filled with some coarse material, might be tapped into the fill every 6 or 8 ft. I have used old boiler flues to tap these water pockets, plugging up the ends and driving them in from the side of the fill at 30 to 50 deg., until well under the track and then driving out the wooden plugs with a long rod. In other places I have used a post-hole auger having a piece of iron rod welded on to make the reach longer, and then started near the center of the track and bored down into the grade at an angle of about 45 deg. This hole was then filled with gravel and another hole bored in the side of the grade to meet it and also filled with gravel. This has proven to be a cheap and effective way of draining such pockets.

I have seen a number of fills where ditches were dug entirely across from 3 to 6 and in some places 8 ft. deep and 4 ft. wide, filling in with boulders and making these cuts at intervals of 8 ft. There was no more trouble with water in such places, but there was just as much trouble with the track as before due to the sides of these ditches caving in, and the gravel and dirt working down around the boulders. This produced a waving surface and it was almost impossible to keep the track up.

Tiling must be used in some cases, but it is worse than useless if it is not placed right. It should not be too deep, nor too far away from the track unless lateral leads are used from the main runs up under the center of the ties. If tiling is placed too close to the track, or too shallow, it will be distorted and pushed out of line. There is no rule which can be applied; local conditions and experience are all that can be relied upon in locating tiles.

In summing up it can safely be said that there are but few sinking or sliding places in the track which could not have been prevented had the proper work been done by locating the cause and removing it, instead of allowing the condition to get very bad before anything was done. In this manner the work can be done with a small outlay; otherwise it may become a gigantic job and prove very expensive.

Chicago, Burlington & Quincy has begun work on the short section between Wendover, Wyo., and Guernsey, to connect the C. B. & Q. line from the junction with the Northern Pacific near Billings with the company's Nebraska lines.

The Kanawha Glen Jean & Eastern of West Va., is making preliminary arrangements to start work soon on the construction of its line to the Laura, Red Star and Harvey Coal Mines. Plans have also been prepared for an extension from Tamroy to Skelton.

The Entwistle & Alberta Southern has been incorporated to construct a railway from Entwistle, Alta., to the Saskatchewan river, about 60 miles. The incorporators include C. L. Hervey, D. A. O'Meara, Montreal, Que.; T. A. Burgess, L. A. Cote and R. H. Pringle, Ottawa, Ont.

LABOR PROBLEM AT GREEN SPRINGS

At the Baltimore & Ohio Railroad Company's timber preserving plant at Green Spring, West Virginia, on the Cumberland Division—the busiest traffic section of the system—there are employed between 200 and 300 men, most of whom are pieceworkers. They handle about one million ties a year for treatment.

The labor situation at this plant is peculiar and it offers a good opportunity for the economist and sociologist to ventilate their theories on the service and comfort of a class of laborers that ordinarily do not work on the railroad.

By birth, or habitual wandering, the unskilled laborer applying for work at the timber preserving plant claims to be an American, a German, a Frenchman, an Italian, a Scandinavian, an Austrian, a Pole, a Russian, in fact, an offspring of nearly every nationality.

Many of these laborers are illiterate, and the dominant characteristic is their indifference as to their future welfare; they live for the present and work when it pleases them. Generally they are wanderlusters and crave a constant change in occupation.

Physically many of these foreigners look as though they could toss a tie of 200 or 300 pounds with one hand and repeat the performance many times a day. A careful study of the individuality and skill of these tie handlers has developed some surprising views. It is not always the man of huge muscle and tall stature who can stand the hard work longest. Sometimes the small man with moderate muscle is the better worker and will stick longer on the job. He often exhibits greater mechanical ability than his Sandow co-worker and seems to be less awkward in handling the ties which measure 8½ feet by 7 inches by 8 inches.

There have been men employed at the B. & O. timber preserving plant whose appearance would indicate that they were physically unfit for the work, but when they have been put to the test it was proved that they had the dexterity to handle ties more rapidly and for a longer period than their better developed sidepartners. It is a significant fact that men with a rugged appearance will often quit the job before their supposedly weaker companions. Fatigue usually develops after a few days' work, and if the tie handler has not the skill he invariably is "done up" before the week is around.

Amateur tie handlers have the failing of over-exerting themselves, for they strive to increase their earnings too quickly. They work nervously and will soon tire from their wasted energy. The experienced tie handler seems to use less exertion and goes about his work with ease. He knows just how to tackle a tie and his judgment in team work is quite a factor in running up a big day's score for both men.

For some time after commencement of operation at the plant (in May, 1913) labor was scarce and very unsatisfactory in character. Negroes were in the majority, and it must be confessed a good part of this class of labor was symbolical of the "scum of the earth." As a rule negro labor has proven to be unreliable. The negro will work when it suits his convenience, for he has neither ambition nor the stick-to-it-ive-ness which is characteristic of the better class of unskilled white labor. The negro generally thinks pay day is the beginning of a two or three days' holiday and the plant employing him may just as well shut down on pay day. His earnings are usually spent in riotous living, and when the negro has partaken too freely of poor mountain whisky he is a dangerous character and will "cut up" anyone who dares to interfere with his unlawful celebration of pay day. When the intoxicated negro's fiendish energy has been spent he will fall asleep and it usually takes from 24 to 48 hours to bring him back to his senses. He will then

return to work, and it is necessary to humor and drive him alternately to accomplish the duties expected of him. Occasionally a good worker is found among the negro laborers and he will sometimes earn more in handling ties at the piecework rate than many a clerk in the railroad service.

It is not an unusual occurrence to see an industrious negro handle from 100 to 200 or even 400 or 500 ties per day, which at the piecework rate of 1½c per tie is equivalent to $1.50 to $7.50 per day; but the average earnings seldom exceed $2.50 or $3.00 per day. There are now comparatively few negroes employed at the B. & O. timber preserving plant. Austrians are preferred, as they have the reputation of being among the best tie handlers that can be obtained. The Austrian is stockily built as a result of his rugged outdoor life, hard work and diet, which consists largely of meat and potatoes. The Austrian is jovial and peaceful and seems satisfied to work hard so long as he earns enough to permit him to save for the inevitable rainy day.

In order to keep the Austrians at the tie plant it has been necessary to colonize them under a fellow countryman who has had this peculiar experience, but owing to the European war some of the Austrians have left to enlist under the colors of their native land.

Comparatively few Italians care to handle ties at a piecework rate, for they can earn $1.75 per day at track work, a job on which they do not have to expend as much muscular energy as they would at the tie plant. To earn $1.75 per day at the tie plant a man must handle 117 ties, which at an average weight of 225 pounds per tie would be equivalent to about 13 tons.

Americans as a rule do not continue long at the work of handling ties, for they soon find the work too heavy and uncongenial. The American will sometimes hold on to his job as tie handler with the hope that he will eventually be given charge of a gang of foreigners whom he can boss at a regular daily wage.

Unskilled labor for the timber preserving plant at Green Spring is obtained through the Baltimore & Ohio free labor bureau and its correspondents at Pittsburgh, Chicago, St. Louis, Cincinnati, and other leading cities. Usually an order is placed with these labor agencies for a certain number of tiemen to be furnished daily, this number varying with the requirements at the plant, and is also influenced by the fact that only a few of the men sent remain to work. These laborers are usually shipped in gangs at the expense of the railroad company and each individual is tagged for identification at destination.

When they arrive at the plant the laborers are requested to register at the office, but as many of them can neither read, write nor speak English all are given a number and their names, as nearly as can be understood, are entered on the register by the clerk. It is surprising how many of these foreigners hesitate to acknowledge that they are married, but when it is learned that some of them have abandoned their families or are trying to evade arrest it will be understood why they wish to hide their identity. There are cases on record where deserted wives have sought their erring husbands; a mother, her wayward son; an employer, a dishonest employee; a creditor, a debtor; a detective, a fugitive from justice; but the culprit usually manages to get away before he is identified.

It is encouraging to note that a better class of labor is now at work at the B. & O. timber preserving plant, for the men are beginning to realize that their occupation is permanent and the food and lodging cheaper and better than the average.

At the plant the unskilled labor is divided into three gangs, all pieceworkers, and each gang is in charge of a foreman. The back track gang, consisting of 16 to 30 men, according to the number of cars of green ties to be unloaded in the yard, are paid at the rate of 1½c per tie. Should the ties be checked (split) "S" irons are driven into them, and for this work the plant pays ¼c per iron. The men who drive the "S" irons earn good wages and their occupation is assured by the fact that during the seasoning of ties in the yard from six months to a year there is certain to be more or less checking, especially if the ties are of the softer woods.

The back track gang not alone unloads green ties on the ground to season, but also cribs them. The ties are cribbed seven on one, that is, placing one tie one way and seven the other, and a crib twenty tiers high contains 105 ties.

After the ties have been properly seasoned in the open air they are picked up and loaded on small tram cars. This work is done by the truck gang, which is in charge of a foreman and consists of about twenty men who are paid at the piecework rate of 60c per tram. A tram contains an average of about 43 ties, and 15 of these trams constitute a retort charge. Between five and eight charges are run through daily, according to the rapidity of absorption of the preservative. When the trams are loaded direct from the cars the men on the truck gang receive 65c per tram, which includes shifting the trams and sorting the ties as instructed by the foreman.

There are two retorts, each 132 feet 1¼ inches long and have an inside diameter of 7 feet. The retorts have a dome 3 feet by 3 feet and a track upon which the tram cars containing the ties rest during the period of impregnation. Each retort weighs 168,520 pounds and has a capacity equivalent to 5,207 cubic feet, or 38,954 gallons in preservative solution. It requires two men to operate each retort door. To properly treat ties requires from five to eight hours, depending on the seasoning they have had; the longer the seasoning, the quicker the absorption of the preservatives and consequently the shorter the period of treatment. When treated the trams containing the ties are withdrawn from the retort by a narrow gauge locomotive and are pulled to the depressed loading platform where the platform gang loads the ties into the standard gauge cars for shipment. The loading of treated ties into standard gauge cars is done either by hand at the piecework rate of 45c and 50c per tram, according to the style of car loaded, which includes stamping ties; or when loading is by means of the well known Angier tie loader the piecework rate is 45c per tram. This tie loader, invented by the superintendent of the Timber Preserving Plant, will do the work of three men at a material saving in cost of loading treated ties. In construction the tie loader is simply an "L" shaped steel hook with teeth to prevent the ties from slipping. This hook is suspended by a chain from an overhead portable trolley which connects with the top of the box car to be loaded.

Loading treated ties into the cars from the ground or crib by hand is paid for at the rate of 1c to 1¼c per tie. Cribbing treated ties, however, is not a common practice at the B. & O. plant, and is only resorted to when the supply of cars for shipping out the treated ties is insufficient to meet the requirements. The piecework rate noted above for the Platform Gang includes all labor necessary to load cars, such as staking flat cars, standing ties upright around the ends and sides of coal cars, switching tram cars and doing all other work requested by the foreman.

Loading cars with treated ties is a problem, and owing to their heavy weight and slippery nature (due to their wet creosote surface), it would be imprudent to try to load the cars in the same way as untreated ties. With the sharp curves and varying grades on certain points of the railroad it is necessary to use great caution in loading cars with treated ties. "Safety First" is the watchword of all employees of the B. & O. Timber Pre-

serving Plant. The standard gauge cars are therefore loaded to the safety point, which in many cases is about 85% of their stenciled capacity. A standard locomotive switches the cars from the yard to the main line where they are attached to the regular freight trains.

In October of last year the attempt was made to adopt the bonus system of pay for the various gangs, the object being to encourage the tie men to do more work in less time so as to handle expeditiously the largely increased number of cars of ties received for treatment.

The bonus system was discontinued in December when the management requested that expenses be reduced to conform to the general plan of economy in operating the railroad.

Under the bonus system pieceworkers realized a very good income, some making more money than their foreman, and it should be stated that they accomplished the amount of work anticipated.

Recently adzing and boring ties for screw spikes was undertaken at the B. & O. Timber Preserving Plant. A number of these ties have been treated and have been placed in track on the Magnolia Cut-off. (See December issue of *Engineering*.) Hand wood boring machines operated by compressed air, are used and the men show unusual skill in their work. The ties bored are all sawed hardwood.

One of the greatest difficulties in effecting a permanent working force at the B. & O. Timber Preserving Plant at Green Spring has been the absence of houses in which employees and their families may live. Some months ago an attempt was made to overcome this difficulty by constructing several cottages from old box cars that had been removed from their trucks. Each cottage has been constructed of three box cars, two placed parallel to each other and separated for a distance equal to the width of both cars, this space being boarded up to make an additional room. The third car has been set back between the two parallel cars, making in all a living room, kitchen and two sleeping rooms. These box car cottages are so situated that there is sufficient ground around them to plant vegetables for food and flowers for decoration. The cottages are rented to the tiemen for a small sum.

In additon to these box car cottages and the boarding camp layout described below, two passenger coaches have been fitted up near the plant office for the accommodation of the clerks and unmarried men. The passenger coaches have been converted into five sleeping rooms, living room, kitchen and a comfortable reading room. They are electrically lighted, and there is running water and have steam heating coils to insure comfort during the cold weather.

A feature of the plant is the commissary, which is in charge of an experienced boarding house keeper, and there is also a bathhouse with sprays for hot and cold water. This camp is equipped with comfortable bunks, can accommodate 65 men, and the food is good.

The railroad company guarantees to deduct from the wages of the men any debt that is contracted for board and lodging or commissary, provided the purchase of commissary has been approved by the foreman of the plant.

To keep a record of the meals an original brass check system has been introduced, and it is the custom of the manager at the end of the day to check his accounts with the plant office to avoid an accummulation of bad debts. No liquor is sold and gambling is prohibited on the property of the B. & O. Timber Preserving Plant.

Owing to the ruling of the Interstate Commerce Commission the manager of the camp is obliged to pay all transportation charges of his help and supplies. Previously the railroad company carried both free.

Fuel and water are furnished the camp by the railroad company without cost, and no rent is collected for the use of the box cars that have been converted into the boarding and lodging quarters of the camp.

It is worthy of mention that the railroad company has issued strict instructions in regard to boarding camps on its system. Ordinarily the foreman is held responsible for properly maintaining and policing all camp car bunk houses occupied by men under his charge. At the B. & O. Timber Preserving Plant there are two special officers (regular employees), one on night duty, the other on day duty, and they maintain order. On other parts of the system the master carpenter, supervisor and section supervisor are expected to inspect the camps frequently to see that their men do not violate the regulations of the railroad company.

Whenever camp cars are set off their trucks for permanent use as bunk houses the railroad company requires that they be placed at an inconspicuous location away from the main track, station and dwellings. Sometimes, however, it is impossible to abide by this ruling, but the camp cars are generally located as specified and are well ventilated, neatly painted and kept in good repair. When the camp cars are located temporarily at a certain point the railroad company insists that they be placed on temporary tracks or on a back track away from the main lines. When the camp cars are placed on an operated track, ties must be set in or rails taken out to prevent freight or passenger cars from being run against the camp cars. Should it be necessary to locate the camp cars on a track next to the main track or running track then the cars must be closed on the side next to such track. The use of ladders or walkways on the side of the cars next to such track is prohibited.

The railroad company insists that all camps, either car or bunk house, must be supplied with privies placed on holes of sufficient depth to insure complete covering when abandoned. Frequent application of quicklime must be made to insure complete disinfection. Garbage must be collected in metal cans provided for that purpose, and the garbage burned or buried every day.

Wash water from sinks and wash basins—the incubators of disease germs—must be collected in a barrel and emptied in a water course at a sufficient distance from the camp. Debris, such as boxes, paper, etc., must be cleaned up daily and burned.

It is also imperative that special care be taken to provide a sufficient supply of pure water, and where necessary wells should be driven, suitable pumps provided and the top of the well so constructed as to prevent contamination. The railroad company requests that local sanitary and health laws and ordinances be complied with to avoid friction with the authorities.

At the Timber Preserving Plant the management is making a special effort to carry out the company's rules and regulations as outlined above, and the result is that employees are becoming better satisfied and there is hope of building up a permanent, prosperous community at Green Spring in the valley of the Alleghanies.

The Chicago, Burlington & Quincy is reported to have completed surveys for 200 miles of new line in Missouri. It is said that work may be started next summer on line from St. Joseph to Mexico, Mo.

Surveys are being made by the Doty Lumber & Shingle Co. for the construction of a five-mile extension to its railway from Doty, Wash.

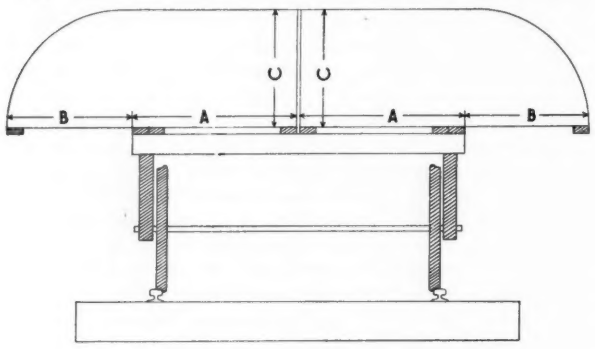
Surveys are under way for 30-mile line from Sapulpa, Okla., to Oilton. C. N. Haskell, Tulsa, and Wm. Murdock, Jennings, Okla., are interested. J. J. Harrison is Engineer.

DUMP BOXES FOR HAULING DIRT

By A. M. Van Auken

Changing methods of doing routine work on sections is the order of the day. We are having another shift in the matter of labor supply, with a probability of still another at the close of the present war. To some extent the newer appliances are helping in the adjustment of available forces to meet multiplying needs. The motor car is one of the helpful aids in the new condition. A recent inspection trip showed several ways in which the car was being used to help increase the accomplishment of available labor.

A motor car was attached to a push car, the latter being fitted with dump boxes, and the force was cleaning and widening the ditches through several cuts. The advantage of this method is apparent. The work can be done as soon as the debris in the ditches begins to cause standing water and before the water softens roadbed or slope and causes more trouble. In the old days it was necessary to wait for the arrival of the ditcher, if the road had one, or to get out a work train. When the latter was done the cost mounted, and owing to the height of the flat car, double that of the push car, the men



Dump Boxes for Hauling Dirt

can shovel but about one-fourth as much material onto them as they can onto the push car. Where no motor car is available, it is expensive to move the waste any considerable distance. The alternative of having the ditches cleaned out by teams with scrapers was often unsatisfactory and always expensive, owing to the distance the material was moved to reach a dumping point. In many places where the amount to be moved is small, the motor car, push car and dump boxes greatly reduce the cost over older methods.

The same equipment was being used by another foreman to strengthen, widen and raise the roadbed at the ends of bridges; in this case the track was unballasted. Much trouble had been encountered. This foreman was using material from a cut some distance away thus accomplishing two improvements with one operation, improving conditions in the cut and at the bridge ends for the approaching bad season. The distance was so great as to have precluded the material being moved without the motor car.

Another foreman who had also used his equipment as above was bringing stone which he had picked up along the line and using it for rip rap to protect the toe of the slope at one bridge opening. This work was being done at a cost below that of any other known method, but part of this was due to the favorable location of available stone.

Several foremen had been helping bad spots in their track by bringing out loads of cinders on the push car and fixing up bad spots before they got worse.

This widening use of the motor car is one of the cheering signs. It is not possible to put into dollars the savings resulting from such work. We may never know how many derailments have been prevented or how often damage to equipment and even loss of life is prevented by this mending of bad spots in roadbed, reducing danger of losing track at a trestle and like work.

DESCRIPTION OF DUMP BOXES

The dump boxes illustrated herewith are constructed as follows: The width of the top of the push car is taken as a unit and the full width of each dump box is ⅞ of the width of the top of the car. Distance A in the sketch is one inch less than half the width of the top of the car and distance B is one inch more than ⅜ the width of the top of the car. The depth may be about one-third the width of the top of the car. Thus a car with a top width of 6 feet, may have the box 5 ft. 3 in. wide, 2 ft. deep and the same length as the car. A cleat may be fastened to each side of the car as shown and one of the cleats should be placed as indicated in order to prevent the box sliding off the car when dumping. The bottom of the dump box should be made so that the dirt when sliding out of the box will run with and not across the grain of the bottom boards. The bottom should be made of dressed lumber to facilitate dumping and it should also be painted if possible.

GOVERNMENT POSITION OPEN

The United States Civil Service Commission announces an open competitive examination for junior railway civil engineer on June 23rd, 1915. Grade 1 will pay from $1,200.00 to $1,680.00 a year and grade 2 from $720.00 to $1,080.00 a year with expense when absent from headquarters.

The education, training and experience of the applicant will be given a weight of 50 and an examination in railway surveying and mathematics will be given a weight of 50. The questions under the first subject will be based on the work usually covered in the first 2 years of a civil engineering school, but applicants are not required to show that they have actually attended such a school.

Applicants in grade 1 will be required to show four years' experience in railway engineering, two years of a responsible nature. Applicants for grade 2 will be required to show that they have had two years' experience in railway engineering and at least six months of this experience should have been running instruments and keeping field notes. Further particulars can be obtained from the United States Civil Service Commission, Washington, D. C.

The Chicago & Northwestern will expend about $300,000 at Sioux City for improvements to include new freight depot, remodeling passenger depot and trackage.

Plan reported under consideration for 1½ mile railroad from Custalota, O., to Big Prairie. John C. Lake, Big Prairie, is in control.

The Winfield R. R. is in the market for one consolidated locomotive of about 33,000 pounds tractive power and also wish to dispose of 2 consolidated loco-

PERSONALS

S. H. BARNES, who has been appointed general superintendent of the Missouri, Oklahoma & Gulf Ry., at Muskogee, Okla., was born November 26th, 1860, in Stark County, Ohio. His first railroad position was that of telegraph operator, since which time he has filled various positions in the operating, construction, maintenance and mechanical departments. He was with the Colorado Midland during the construction of its line across the Rocky Mountains, after which he held the position of division superintendent of the Choctaw, Oklahoma & Gulf, and the Denver & Rio Grande. The last position he held before being appointed general superintendent, as mentioned above, was that of superintendent of the transportation and mechanical departments of the Midland Valley R. R.

R. G. DOWELL, who has been appointed general superintendent of the Mansfield Ry. & Transportation Co., was born September 25th, 1880, at Spencersberg, Mo., and

R. G. Dowell

was educated in the Logan County schools at Mulhall, Okla. He worked in the lumber business with Whited & Wheless until June 13th, 1905, when he entered the service of the St. Louis Southwestern Ry. as agent, and remained in the transportation department of that line until July 1st, 1913, when he was appointed secretary and treasurer of the Mansfield Ry. & Transportation Co. July 7th, 1913, he was elected a director in the M. R. & T. Co. and held that position until appointed general superintendent as noted above.

C. A. HAWKINS has been appointed superintendent of the Nezperce & Idaho R. R., with headquarters at Lewiston, Idaho, succeeding Mr. W. A. Pease. Prior to this he held positions as follows: From 1887 to 1889, stenographer and clerk of the Soo Line; from 1898 to 1894, clerk for the N. P . Ry., at Sprague, Wash.; 1898 to 1904, clerk and chief clerk, superintendent's office, N. P. Ry., Spokane, Wash.; 1909 to 1915, accountant and lease agent Camas Prairie R. R. Co., at Lewiston, Idaho.

E. A. HADLEY, who has been promoted from assistant engineer to chief engineer of the Missouri Pacific Ry., was born in Lowell, Mass., in 1879, and was educated in the common schools, graduating from the Lowell High School in 1897. He worked for Smith & Brooks, civil engineers, Lowell, Mass., as an apprentice from 1897 to 1901, where he secured a combined course of engineering study and practice. He went with the Boston & Maine R. R. as draftsman, in 1901, and was later assistant engineer and resident engineer till 1910. During the last five years he was engaged on heavy construction work, particularly the elimination of highway grade crossings, handling that class of work from preliminary plans to final completion. On June 1st, 1910, he started with the Missouri Pacific as engineer of design.

J. B. HUNLEY, who has been appointed engineer of bridges and structures of the Big Four Ry., was born at Terre Haute, Ind., August 12th, 1881. He attended the public schools and graduated from Rose Polytechnic Institute, Terre Haute, civil engineering course in June, 1903. He entered the service of the Big Four Ry. May, 1903, in the construction department, and since 1907 has been assistant engineer in the chief engineer's office, being assigned to various work. In 1907 he went to Beech Grove shops, where he had charge of grade separation and other construction work. From 1908 to 1915 he was in charge of the drafting and designing room in the chief engineer's office, which position he held until appointed engineer of bridges and structures, as noted above.

M. C. HUTCHINS has been appointed assistant engineer of the Southern Ry., at Washington, D. C., succeeding T. B. Merrick. He entered the service of the Southern Ry. in the maintenance of way department in February, 1912, at Knoxville, Tenn. The seven years previous to his Southern Ry. service were spent in various places from Pennsylvania to Florida, engaged in railroad work, location, construction and maintenance of way.

P. S. LEWIS, who has been appointed supervisor of the Atlantic City R. R., at Camden, N. J., was born at Springfield, Ill., May 10th, 1889. July 1st, 1911, he entered the service of the Philadelphia & Reading R. R. at Williamsport, Pa., as rear rodman. July 1st, 1912, he was appointed concrete inspector at St. Clair, after which he was appointed signal inspector with headquarters at Philadelphia, where he remained until appointed supervisor, as above mentioned.

E. J. FITZGERALD has been appointed general manager of the Bartlett-Western Ry. at Bartlett, Texas, succeeding H. A. Breihan.

E. B. MITCHELL has been promoted from assistant superintendent to superintendent of the Colorado & Southern Ry. at Denver, Colo.

J. E. MAWN has been appointed superintendent of the Central Vermont Ry. at St. Albans, Vt., succeeding S. S. Russell.

M. A. MULLIGAN has been appointed superintendent of the New York division of the Lehigh Valley R. R., succeeding M. C. Roach.

H. R. CARPENTER, engineer maintenance of way, has been promoted to assistant chief engineer of the St. Louis district of the Missouri Pacific Ry., with headquarters at St. Louis, Mo.

A. F. DORLEY, principal assistant engineer, has been promoted to engineer maintenance of way of the St. Louis district of the Missouri Pacific Ry., succeeding H. R. Carpenter.

SAMUEL G. FAIRCHILD has been appointed chief engineer of the Anthony & Northern Ry., at Hutchinson, Kans.

O. E. SELBY, engineer bridges and structures, has been promoted to principal assistant engineer of the Big Four Ry. at Cincinnati, O.

W. Howe has been appointed locating engineer of the Atchison, Topeka & Santa Fe Ry., with headquarters at Chicago.

J. A. Gillies has been appointed engineer of the southern district of the Atchison, Topeka & Santa Fe Ry., office at Amarillo, Texas, succeeding N. R. Cullings.

J. de N Macomb, Jr., has been appointed office engineer of the Atchison, Topeka & Santa Fe Ry., with headquarters at Chicago.

Joseph Mullen, assistant engineer of the Big Four Ry., has been promoted to special engineer, with headquarters at Cincinnati, Ohio.

C. W. Cochran, engineer maintenance of way of the Big Four Ry., has been transferred from Mt. Carmel, Ill., to Galion, Ohio.

R. H. Howard has been appointed engineer maintenance of way of the Wabash R. R., at St. Louis, Mo.

P. D. Fitzpatrick, division engineer of the Southern New England R. R., has been transferred from Providence, R. I., to Southbridge, Mass., succeeding E. A. Probst.

A. R. McGowan has been promoted from assistant engineer to division engineer of the Intercolonial Ry., at Moncton, N. B.

J. H. Cox has been appointed assistant engineer maintenance of way of the Big Four Ry., at Mattoon, Ill., effective May 1st.

B. S. Dickerson has been appointed assistant engineer maintenance of way of the Big Four Ry., at Indianapolis, Ind., succeeding E. J. Bayer.

J. A. Nichols has been appointed assistant engineer maintenance of way of the Big Four Ry., at Wabash, Ind., effective May 17th. Previous to this he was assistant engineer maintenance of way on the Michigan division, with headquarters at Wabash, Ind.

L. T. M. Ralston has been appointed assistant engineer of the Chicago & Eastern Illinois R. R., at Evansville, Ind., succeeding W. H. Socwell.

W. A. Cowan, resident engineer of the Intercolonial Ry., has been promoted to assistant engineer, with headquarters at Moncton, N. B., succeeding J. J. Richardson.

G. A. Butler has been appointed assistant engineer of the Grand Trunk Ry., at Belleville, Ont., succeeding C. S. Ogilvie.

W. S. Haley has been appointed resident engineer of the New York Central R. R., at Toledo, Ohio, effective May 1st.

R. D. Kelley, assistant engineer of the Missouri, Pacific Ry., has been transferred from Coffeyville, Kans., to Aurora, Mo.

T. L. Landers has been appointed resident engineer of the Intercolonial Ry., at Truro, N. S., succeeding W. A. Cowan. This change was effective May 10th.

J. E. O'Donnell has been appointed assistant engineer of the Southern New England R. R., at Providence, R. I.

C. E. Miller has been promoted from assistant engineer to assistant general inspector of bridges, of the Chicago & North Western Ry.

O. H. Mann has been appointed supervisor of bridges of the Chicago, Great Western R. R., at Hayfield, Minn. He has been with the Great Western for five years.

S. Slayback has been appointed supervisor of bridges and buildings of the Denver & Rio Grande R. R., at Salt Lake City, Utah, succeeding J. L. Thompson.

J. Lindsay has been appointed master carpenter of the Great Northern Ry., at Superior, Wis., succeeding J. Zinke.

J. Zinke, master carpenter of the Great Northern Ry., has been transferred from Superior, Wis., to Melrose, Minn., succeeding A. S. Mathews.

W. A. Adams has been appointed roadmaster of the Houston & Texas Central R. R., at Navasota, Texas, succeeding John Hitt.

A. L. Clapp, roadmaster of the Chicago & North Western Ry., has been transferred from South Pekin to Manlius, Ill.

D. M. Connors has been appointed roadmaster of the Minneapolis, St. Paul & Sault Ste. Marie R. R., at Bemidji, Minn.

Frank Cook has been appointed roadmaster of the Northern Pacific Ry., at Mandan, N. Dak., succeeding Christopher Sponsel, transferred.

R. Craig has been appointed roadmaster of the Yosemite Valley R. R., at Merced, Calif., succeeding Geo. Dudley.

Felix Cullen, roadmaster of the Western Pacific Ry., has been transferred from Keddie to Sacramento, Calif., succeeding E. M. Ritchie, effective May 1st.

J. E. Finley, roadmaster of the Western Pacific Ry., has been transferred from Wendover to Keddie, Calif., succeeding Felix Cullen.

J. J. Edwards has been appointed roadmaster of the Norfolk & Western Ry., at Martinsville, Va., succeeding E. D. Foley.

P. Freeman, roadmaster of the Galveston, Harrisburg & San Antonio Ry., has been transferred from Del Rio to El Paso, Texas, succeeding P. E. Kelly.

R. Grillis has been appointed roadmaster of the Canadian Northern Ry., at Rocky Mountain House, Alta.

John H. Hayes has been appointed roadmaster of the Northern Pacific Ry., at Moscow, Idaho, succeeding Frank Hartman. This appointment was effective May 3rd.

J. E. Henderson, roadmaster of the Atchison, Topeka & Santa Fe Ry., has been transferred from Topeka to Emporia, Kans.

E. Hightower has been appointed roadmaster of the Denver & Rio Grande R. R., at Green River, Utah.

G. A. Johnson, roadmaster of the Minneapolis, St. Paul & Sault Ste. Marie Ry., has been transferred from Federal Dam to Thief River Falls, Minn.

A. Maher has been appointed roadmaster of the Texas & New Orleans R. R., at Jacksonville, Texas, succeeding A. G. Savage.

C. Miller, roadmaster of the Atchison, Topeka & Santa Fe Ry., has been transferred from Moline to Independence, Kans.

M. J. O'Loughlin has been appointed roadmaster of the Missouri Pacific Ry., at LeRoy, Kans.

R. L. Pryor has been appointed roadmaster of the Atchison, Topeka & Santa Fe Ry., at Hutchinson, Kans., succeeding A. West.

L. J. Raymond has been appointed roadmaster of the Atchison, Topeka & Santa Fe Ry., at Belvidere, Kans., succeeding S. McGaughey.

S. C. RAMSEY, roadmaster of the Missouri Pacific Ry., has been transferred from McGehee to Pine Bluff, Ark.

E. M. RITCHIE, roadmaster of the Western Pacific Ry., has been transferred from Sacramento to Wendover, Utah, effective May 1st.

G. SLUSHER has been promoted from acting roadmaster to roadmaster of the Atchison, Topeka & Santa Fe Ry., at Topeka, Kans., succeeding J. E. Henderson.

OSCAR RAESMUSSEN has been appointed district roadmaster of the Cuba R. R., at Fomento, Cuba.

CHRISTOPHER SPONSEL has been appointed roadmaster of the Northern Pacific Ry., at Garrison, Mont., succeeding Frank W. Barnes. This change was effective May 26th.

A. J. THOMPSON has been appointed roadmaster of the Galveston, Harrisburg & San Antonio Ry., at Sanderson, Texas.

A. BAIER has been appointed supervisor of track of the Big Four Ry., at Springfield, Ohio. Prior to this he was section foreman at West Liberty, Ohio, and has been in the service of this company for twenty years.

F. K. BENNETT has been appointed supervisor of track of the Minneapolis & St. Louis R. R., at Monmouth, Ill., succeeding J. O'Hearn.

I. M. BROWN has been appointed supervisor of track of the Big Four Ry., at Indianapolis, Ind.

J. L. BUZARD has been promoted from extra gang foreman to supervisor of track of the Chicago Great Western R. R., at Carroll, Iowa, effective May 1st.

E. J. EASTIN has been appointed supervisor of track of the Chesapeake & Ohio R. R., at Summit, P. O. Cincinati, O., succeeding W. J. Whipple, transferred.

M. HENRY, supervisor of the Chicago & Eastern Illinois R. R., has been transferred to Villa Grove, Ill., succeeding J. Ryan, Jr.

J. J. LANIN has been appointed supervisor of track of the Chicago Great Western R. R., with headquarters at New Hampton, Iowa.

M. MCDONNELL, supervisor of track of the Chicago Great Western R. R., was transferred from Hayfield to St. Paul, effective May 1st.

WM. MACKLING has been appointed supervisor of the Toledo & Ohio Central Ry., at Bucyrus, Ohio. Previous to this he held the position of supervisor for the Z. & W. Ry., at Fultonham, Ohio.

R. C. PATTON, supervisor of track of the Chesapeake & Ohio R. R., has been transferred from Thurmond to Hinton, W. Va.

C. A. PFALZGRAFF has been appointed supervisor of the Cumberland Valley R. R., at Chambersburg, Pa., effective May 1st. Previous to this he was supervisor of the Buffalo division of the Pennsylvania R. R.

W. T. POAGUE has been appointed supervisor of track of the Chesapeake & Ohio Ry., at Thurmond, W. Va., succeeding R. C. Patton.

J. RYAN, junior supervisor of the Chicago & Eastern Illinois R. R., has been transferred from Villa Grove to Watseka, Ill.

J. E. SHEA has been appointed supervisor of the Chicago & Eastern Illinois R. R., at Salem, Ill., succeeding M. Henry, transferred.

E. E. SWEENEY, supervisor of the Chicago & Alton Ry., has been transferred from Alton to Roodhouse, Ill.

T. SLATTERY has been appointed supervisor of track of the Erie R. R. at Buffalo, N. Y., succeeding G. Lowers.

C. A. STANLEY, supervisor of track of the Chesapeake & Ohio Ry., has been transferred from Hinton to Richmond, Va.

J. W. STRONG, supervisor of track, of the Chesapeake & Ohio Ry., has been transferred from Quinnimont, to Thurmond, W. Va.

W. J. WHIPPLE, supervisor of track of the Chesapeake & Ohio Ry., has been transferred from Summit, O., to Clifton Forge, Va., succeeding W. C. Pearce.

C. T. CHRISTENSON has been promoted from section foreman to assistant roadmaster of the Great Northern Ry., at Great Falls, Mont., succeeding J. R. McGarvey, effective May 1st.

J. B. CLAPP has been appointed assistant roadmaster of the Great Northern Ry., at Marcus, Wash., succeeding J. A. Thompson.

C. RUTHERFORD has been appointed assistant roadmaster of the Great Northern Ry., at Northport, Wash., effective May 9th.

C. E. EMPSON has been appointed supervisor of signals and interlocking of the Big Four Ry., at Mattoon, Ill., succeeding J. P. McGill.

F. F. HAMMES, signal construction foreman of the Chicago, Milwaukee & St. Paul Ry., has been transferred from Milwaukee, Wis., to Savanna, Ill.

CLARENCE HORNICKER has been appointed supervisor of signals of the Missouri Pacific Ry., at Wynne, Ark., succeeding R. R. Pollock.

G. A. KIRLEY has been appointed assistant signal engineer of the Boston & Albany R. R., with office at Boston, Mass.

ULTIMATE ECONOMY IN MAINTENANCE

By W. E. NORMAN, Section Foreman

The first place that a cut is made when a railway must reduce expenses is in maintenance of way labor. This continues year by year, with a result that the condition of the tracks is getting constantly worse. Of course, the roads also try to economize on material and many employes are not as careful in this regard as they should be; but the track men cannot make all of the necessary saving and besides it seems to me that some expenses could be cut without reducing the maintenance force.

The place where a great deal of money is spent is for ballast. The stone and gravel used cost an immense amount of money. And with such solid ballast it costs more to surface track, renew ties and change rails. Ties and rails do not last as long in stone ballast. Frequently after the ties are put in and a few trains have passed over the track, the ties will be left swinging and still the surface of the track will appear good when sighting over the rails. But when a train passes, the ties will give under it and this makes rough riding track. I believe that engine cinders make fully as good ballast as stone or gravel and that besides costing less, it will give the rails and ties a much longer life, due to its resiliency. And a man can put in about 3 ties in cinders to one in stone. In this way the initial cost of stone and gravel could be saved and the maintenance would be a good deal easier and cheaper.

HIGH PRESSURE STEAM TEST OF PORTLAND CEMENT *

The Force autoclave test was briefly described and commented on in our issues of August 1912, and March 1913. It was at that time incorporated in the standard cement specifications of the D. L. & W. R. R. and its general adoption was strongly advocated by many consumers, and even the government. This opened up an extensive controversy between the cement manufacturers and the consumers. Many brands of American cement would not meet the requirements of this test, and the manufacturers therefore contended that it was an abnormal one and that the behavior of cement when so exposed was no criterion of its ultimate behavior under normal conditions. The United States Government for these reasons made an investigation of the value of the high pressure steam test, the results of which are herein given.

This investigation included a study of the physical properties of cements that were sound after exposure in high pressure steam, and cements that failed to meet the requirements of this test. Tests were made of the tensile and compressive strength in mortars, compressive strength in concretes and the linear change of neat cement prisms stored in air, in water, and treated in high pressure steam.

The following summary of the results of this investigation is of interest: The general soundness tests show that some cements mixed neat, which are sound according to the standard atmospheric steam test but unsound in high pressure steam, exhibit signs of unsoundness when stored under normal conditions in dry air. This unsoundness may require 9 months or more to develop in neat cement specimens.

The strength tests of mortars and concrete fail to show any difference in the cementing quality of cements that pass the high-pressure steam tests and those that fail to meet the requirements of this test. There is but small difference, if any, in the linear change of prisms made of cement that passes the high pressure steam test and the prisms made of cement that fails to meet the requirements of this test, whether stored in air or water. Of a total number of 51 brands of Portland cement tested, 70% passed the high pressure steam test.

Cements normally unsound in the atmospheric or high pressure steam tests will generally be found to be more sound if the coarser particles are removed. While fineness is not essential to soundness, it appears usually to be the coarse particles of a normally unsound cement that cause the expansive action resulting in cracking and disintegration of the hardened cement in the accelerated tests of soundness.

A cement originally unsound in the high pressure steam test will usually be found sound if exposed to this test after aging from 2 to 6 months.

CONCLUSIONS

The following conclusions are drawn from the results obtained: (1) The high-pressure steam test should be made on all cements that are to be incorporated in cement mortar or concrete products that are to be cured in steam above atmospheric pressures; (2) the high-pressure steam test may be of value as forecasting the behavior of neat cement or a very rich mortar when exposed under normal conditions in dry air, but it does not forecast the behavior of cements in concrete as normally exposed; (3) cement passing the high pressure steam test is not superior in cementing quality, as determined from the compressive strength of concretes, to cement that fails in this test; (4) cement passing the high-pressure steam test does not make more permanent or durable concrete, than cement which meets the requirements of the standard specification, but fails in this test; (5) cement failing to pass the standard specification atmospheric steam test, but meeting the other requirements of the standard specifications, shows in some instances a normal strength in concrete; (6) for a normal strength in concrete the results of this investigation fail to show that the high-pressure steam test is of value as a means of determining the ultimate soundness of concrete.

* Abstract of Technologic Paper No. 47 E. S., Bureau of Standards, entitled "On the Value of the High Pressure Steam Test of Portland Cement," by R. J. Wig and H. A. Davis, of the U. S. Bureau of Standards, Washington, D. C.

PRICES OF CONCRETE MATERIALS

The cement market is at present experiencing the dullest period in the past four years. That the market will pick up shortly, however, is indicated by the increased number of jobs out for estimating. In the Pacific Coast territory the market is dull in all lines, but with a little better inquiry than six months ago.

Prices given f. o. b. cars at points named, including cloth sacks, for which, in general, 40c per barrel (4 sacks) is refunded on return in good condition. Prices per barrel (including 4 cloth sacks) are as follows: Boston, $1.46; New York, $1.22; Chicago, $1.46 to $1.55; Pittsburgh, $1.46; New Orleans, $1.58 on dock; Memphis, $1.75; Cleveland, $1.54; Detroit, $1.55; Indianapolis, $1.58; Cincinnati, $1.59; Columbus, $1.58; Toledo, $1.59; Cleveland, $1.54; St. Louis, $1.45; Milwaukee, $1.58; Minneapolis and St. Paul, $1.67; Kansas City, $1.48; Omaha, $1.48; Spokane, $1.75; Seattle, $2.20; Tacoma, $2.20; Portland, Ore., $2.20; Duluth, $1.32.

Crushed Stone—1½-inch stone, prices per cubic yard, f. o. b. cars in carload lots, unless otherwise specified. Boston, 80c per ton at the quarry; New York, 95c, in full cargo lots at the docks; Chicago, $1.15; Spokane, $1.15; Portland, Ore., $1.30; Seattle, $1.65.

Gravel—Prices given are per cubic yard, f. o. b. cars in carload lots unless otherwise noted. New York, 80c, in full cargo lots at docks; Chicago, $1.15; Spokane, $1.00; Portland, Ore., 85c; Seattle, 75c; Tacoma, 75c.

Sand—Prices are per cubic yard, f. o. b. cars in carload lots unless otherwise indicated. New York, 50c, full cargo lots at docks; Chicago, $1.15; Spokane, 75c; Seattle, 75c; Portland, Ore., 85c; Tacoma, 75c.

The bar market is normally active in New York, Chicago and St. Louis, while the mills in San Francisco are operating on a limited scale, business being spasmodic.

Reinforcing Bars—June deliveries will be made on a basis of $1.20 per cwt., Pittsburgh, with prevailing extras for bars under ¾-inch or base. The following are quotations on base bars per 100 lbs. for mill shipments from other points, f. o. b. cars: New York, $1.369; Philadelphia, $1.359; Chicago, $1.389; Spokane, $2.05; Seattle, $1.85; Portland, Ore., $1.85; Tacoma, $1.85; San Francisco, $1.80.

Shipments from stock are being made at the following prices per cwt., f. o. b. cars: Pittsburgh, $1.65; New York, $1.95; Cleveland, $1.80; St. Louis, $1.80; Chicago, $1.85; Spokane, $2.25; Tacoma, $2.15; Portland, Ore., $2.15; Seattle, $2.15; San Francisco, $1.80.

Metal Clips for Supporting Bars—$4.50 to $6.50 per 1,000, depending on size.

For the majority of the prices given we are indebted to the Universal Portland Cement Co., Sandusky Portland Cement Co., Concrete Steel Co., American Sand & Gravel Co., Chicago, and F. T. Crowe & Co., Seattle, Portland, Spokane and Tacoma. Reinforcing bars for mill shipments are in general sold on a Pittsburgh basis; this is, at the Pittsburgh quotations plus the freight to the point in question, and with the following list of freight rates on finished material and the Pittsburgh quotations given, the prices of bars at any of the points listed can be readily computed. (Note increase in Freight Rates.)

From Pittsburgh, carloads, per 100 pounds to:

Albany	16.9 cents	Cincinnati	15.8 cents
New York	16.9 cents	Chicago	18.9 cents
Philadelphia	15.9 cents	Denver	68.6 cents
Baltimore	15.4 cents	St. Louis	23.6 cents
Boston	18.9 cents	New Orleans	30 cents
Buffalo	11.6 cents	Indianapolis	17.9 cents
Cleveland	10.5 cents	Omaha	43.6 cents
Minneapolis	32.9 cents	Pacific Coast	
Kansas City	43.6 cents	(Rail)	80 cents
Birmingham	45 cents		

NEW BOOKS

RAILROAD FIELD MANUAL FOR CIVIL ENGINEERS. By Prof. William G. Raymond, State University of Iowa; 394 pages, pocket book form; price $3.00 net.

This is the newest manual offered to the engineer for field use, and Prof. Raymond makes a bold departure from his predecessors in calculating all his tables for degrees and decimals thereof instead of in degrees, minutes and seconds. Time alone will decide the value of this innovation. The writer in 1889 had a transit made by Young & Sons in which one vernier was divided into decimals of a degree and the other in the orthodox way. He liked the innovation, but was not able to make either of his seven assistants agree with him, and each of them clung to the other vernier and their custom. It is a question whether he or they were out of step. These tables will reduce very nearly one-half the field computations in doing transit work, and should meet with favor. The value of this book depends on the reception accorded this new departure, as two-thirds of the space is given to the new form of tables and the explanatory text. The book appears to have been looked on as an experiment by the publisher, as it is somewhat thicker than Prof. Allen's book, contains 394 as against 524 pages. It is an eighth inch longer and three-eighths inch wider than the other book, making it that much less convenient for the pocket.

The remaining third of the book is given to Location Theories and Tables 14 pages, Estimating and Construction Tables 34 pages, Turnouts and Crossings 8 pages, Tables for Metric Curves 8 pages, and miscellaneous tables 72 pages. These tables are excellent, as is to be expected from the author's previous works.

Alabama, Tennessee & Northern are considering plans for the extension of its line from Reform, Ala., to a connection with the Illinois Central R. R., about 65 miles.

The Baltimore & Ohio will lay 30 miles of new rail between Pana and Beardstown.

PROGRAM FOR MAINTENANCE WORK

By E. E. JEWELL, Foreman

The conditions under which track must be maintained have a good deal to do with the program of work. In this northern country, just as soon as the snow is off of the ground in the Spring, we make it a point to clean up yards, and pick up all scrap that has accumulated during the Winter. Then as soon as the frost is out of the ground we commence putting in ties, keeping a sharp watch on the track in the meantime and picking up places which settle out of line or surface. In putting in new ties I work the men in pairs, and with a gang of 8 men, organize them as follows: 6 men dig out for the ties; 2 men follow up spiking and gaging and I do the most of the dressing off.

I use a small jack and raise the joints a little high so that when new joint ties get settled, they will have the same bearing as the old ones. On curves, or anywhere tie plates are used, I tamp up the ties before applying the tie plates or spiking. This gives the ties an even bearing. With the gang organized in this manner we can put in 70 ties in a 10 hour day and do first class work. We keep after the ties until the ground has thoroughly settled and then start out and surface up all the low places that have developed. While doing this we straighten all sign posts and repair places in fences where the farmers want to turn out stock.

As soon as I can get over my section in this manner, we again start putting in ties and keep up this work until about June 15th when we stop for a few days to weed over the section. We then work on the ties until about July 1st, when we "knock off" to start mowing the right of way, which as a general thing requires about three weeks. We then go back to the work of putting in ties and by the first, or by the middle of September at the latest, I usually have finished putting in all new ties. We pile up old ties and burn them the same day they are taken out if possible.

After September 15th we have the remainder of the Fall to devote to cutting weeds, surfacing and lining track so that by the middle of November we have very little surfacing left, usually nothing but sidings. It is then time to tighten up bolts, and after this I go over my section with a gage and regage any bad track before the ties freeze, as it is not a good plan to gage track on frozen ties.

As soon as snow comes, we have switches and sidings to keep clean as well as tracks around stations. There are many odd jobs that can be done in the Winter, such as cleaning out ditches, grubbing banks, etc.

NEW STRUCTURES

The Atchison Topeka & Santa Fe is about to construct a seven-stall engine house estimated at $23,000 at Prescott, Ariz.

The Atchison Topeka & Santa Fe is planning to build a coal chute, water cranes and construction of additional tracks at Florence, Colo., estimated to cost $55,000.

The Atchison, Topeka & Santa Fe is planning on bridge renewals, replacements and filling on its Southern division; bridge C 1181 on the Valley division; a 420-foot pile trestle extension on the Western division; replacement of bridges D 120 and C 120 on the Los Angeles division, this work to cost $38,600, and other bridge work amounting to $35,000 have been authorized, together with

an undergrade crossing between Serra and Mateo, Cal., which will cost $12,500.

The Atchison, Topeka & Santa Fe is making plans for a combination freight and passenger depot at Kiowa, Kan., at a cost estimated at $50,000.

The Atchison, Topeka & Santa Fe is ready to build an 800-ton mechanical coaling station and sand plant at Albuquerque, N. M., and two locomotive cranes and other improvements at the same point.

The Central of New Jersey contemplates building a new bridge over Jackson Ave., Jersey City.

The Chicago, Burlington & Quincy is reported to have awarded to the Fort Pitt Bridge Works contract for 1353 tons of bridge steel.

The Chicago, Rock Island & Pacific expects to build a small repair shop for light repairing at Biddle, Ark.

The Erie has begun work on a new station at Niles, Ohio. The National Supply & Construction Co., of Niles was awarded the contract.

The Great Northern expects to extend its machine shops at St. Cloud, Minn., 60 feet, which will make that section of the plant 75x260 ft.

The Union Station Co. has let a contract for the superstructure of the Lake street bridge at Chicago and bids have been asked for the bascule bridge to be erected at West Monroe street. These bridges are part of the terminal development.

The Illinois Central is reported to be about to raze the present bridge over the Rock river at Dixon, and to replace it with a new structure.

The Lewisburg & Northern and the Nashville, Chattanooga & St. Louis are reported to have let a contract to build a new passenger station at Lewisburg, to be used jointly.

The Louisville & Nashville is about to let contract for the construction of a steel viaduct over the Eastern Parkway, Louisville, Ky., estimated to cost $12,000.

The Minneapolis & St. Louis and the Chicago and North Western have awarded to J. J. O'Heron & Co., Chicago, Ill., the construction of substructure of the South Third Ave., viaduct. Estimated total cost of structure, $75,000. Viaduct will be about 1,700 ft. long and 34 ft. wide.

The Missouri Kansas & Texas has ordered 2,368 tons of bridge steel from the Wisconsin Bridge & Iron Co.

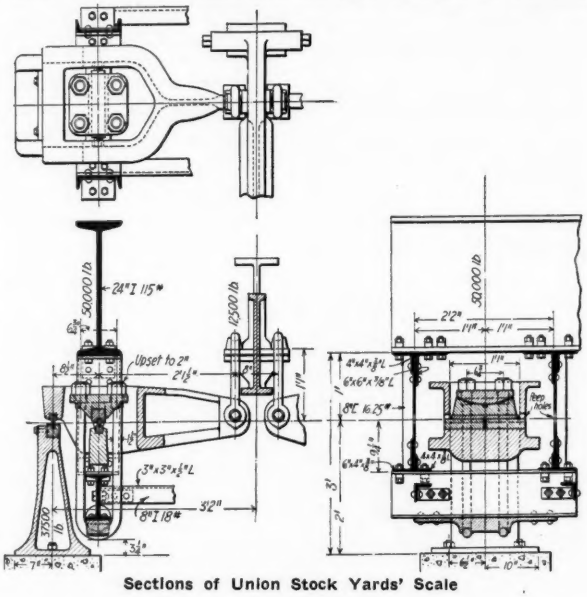
The Oklahoma, New Mexico & Pacific will build a modern brick and concrete passenger and freight station at Ardmore, Okla.

The Piedmont & Northern has given a contract to the Fiske-Carter Construction Co., Greenville, S. C., to rebuild its freight depot recently damaged by fire at Anderson, S. C.

The Southern Railway will construct a storage yard of 400 cars capacity at Charleston, S. C.

UNION STOCK YARDS' SCALE

Morris & Co. of Chicago, have installed a 150-ton Railroad track scale in the Union Stock Yards, Chicago. It is rated at 150 tons, is 50 ft. long and consists of 4 sections with suspension bearings. This scale is designed so that the load is suspended from and not superimposed on the main supporting levers. This is accomplished by means of members having common rotation centers below the levers, thus permitting equalization of the load upon pivots, preventing the displacement of bearings and assuring free axial motion of the main levers. The scale is designed to prevent any effects from deflection of the girders under loads. The scale was figured for a concentrated load of 100,000 pounds on each of the 4 sections and the fiber stresses of the cast

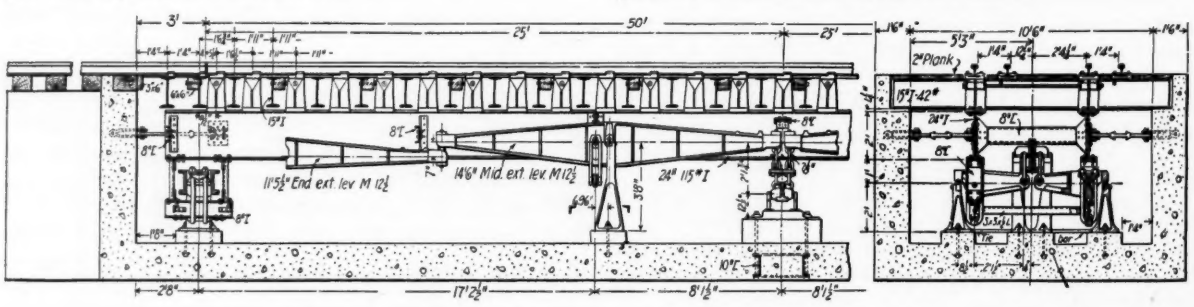


Sections of Union Stock Yards' Scale

iron levers in direct tension were required not to exceed 2,500 pounds per square inch under this load. The specifications required that the knife edges should not be loaded to exceed 4,250 pounds per lineal inch.

The scale, which was furnished by the Standard Scale & Supply Co., Pittsburgh, has 24-in. 115 lb. weigh bridge beams, 15-in. 42 lb. dead rail beams, and is equipped with a Reed Recording Beam.

Bids are desired until June 7 by A. C. Shand, chief engineer of the New York Connecting R. R., Broad Street Station, Philadelphia, Pa., for grading and masonry work on a portion of Section 2, New York Connecting R. R., extending from a point near Bowery Bay to south side of Fremont street, in Borough of Queens, a distance of about 4.21 miles.



Sections Showing Support of End Levers, Union Stock Yards' Scale

AND HENNESSEY DID

And it came to pass that a certain gang foreman upon the Cheaphelp & Dampoor Management Railway was ordered by his master to put in a slip switch near Lonesomeville. Whereupon he arose early in the morning and clothed himself. And after gathering together his tools and men, journeyed upon his gas wagon to Lonesomeville. And lo! his master was there even upon the spot where the slip switch was to be located.

Whereupon he charged him, saying, "Get thee busy, oh Hennessey, thou King of Snipes, for great is my haste. Verily, thou shalt not permit thy snipes to tarry upon this, thy master's work. Nay, not even long enough to scratch their ribs when the lice are seeking to devour them. So bend thy back to thy task or verily my boots shall seek the beginning of thy spine."

Whereupon Hennessey, the King of all Snipes, cursed the day upon which he was born and his snipes also, and after sending out his flagmen attacked the track with great fury and tore it out.

But lo, when he tried to put the switch in place it would not fit. The plates seemed possessed of the devil and the rails would not come to gage.

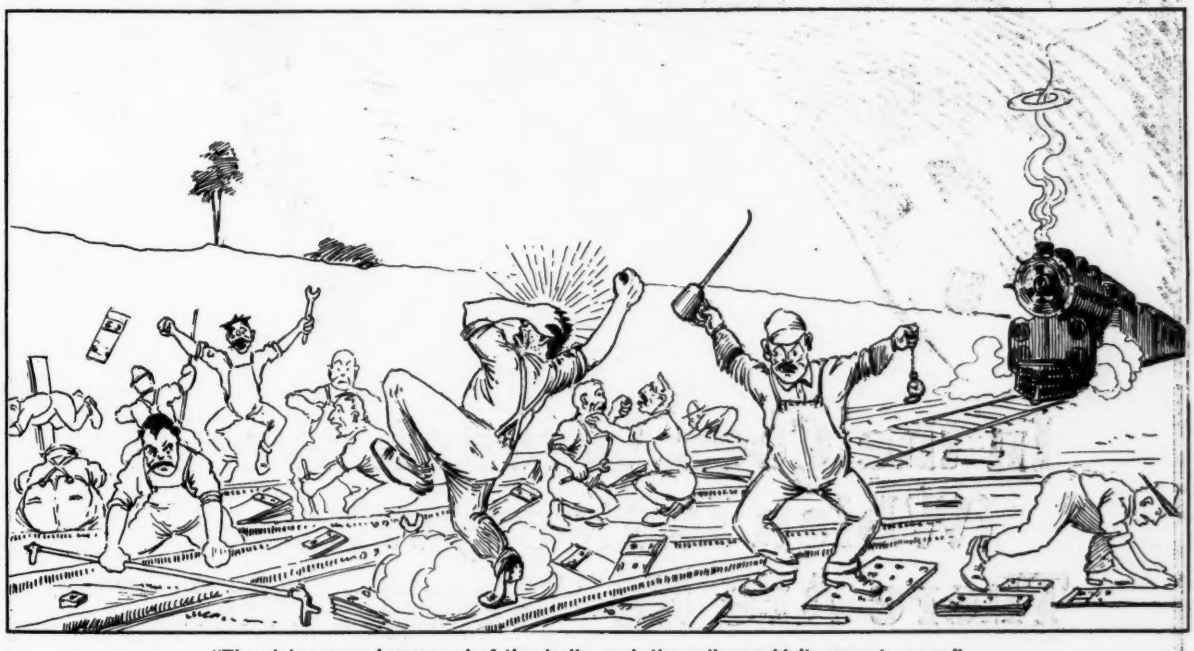
Whereupon Hennessey screamed with rage and tore his hair, likewise he bathed the snipes in blasphemy when the Limited approached and was held by the flag, for lo—the track was torn up!

Now it came to pass that Hennessey's master, even the Great ROAD master, descended upon him with a motor car. Verily he was very wroth, because of the delay of the Limited he had been Bastinadoed and scourged by his master the G. M., who was also wroth because of the clubbing given him by his master even the President of the Road. And great was the anger of the President, for verily he had been tarred and feathered by the Board of Directors and his very soul cried out for blood. Now the Righteous ones of the Board of Directors were in sack cloth and ashes because of the blistering which they had received from Uncle Samuel, whose mails had been delayed upon the Limited.

And in the heat of his anger the R. M. descended upon the cause of the trouble—even Hennessey, King of Snipes. Verily the fires of Hades would be even as cooling streams when compared to the vapors which issued from the mouth of the R. M.

"My heart is torn and bleeding because of thy blunder, thou red muzzled ballast flea!" Thus spake the R. M.

"Despatch with all haste a letter to RAILWAY ENGINEERING and order a copy of Van Auken's "PRACTICAL TRACK WORK," which teaches thee how to put in a slip switch, even if standing on thy head. Verily, if this order is not fulfilled, thou wilt be dismissed from the Road of the Faithful without further notice, and mayhap pass the rest of thy days as a common Snipe."



"The plates seemed possessed of the devil and the rails wouldn't come to gage."

Write today for Circulars describing Practical Track Work . . . . .

Railway Engineering

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A Coes Wrench has the backbone to loosen anything that has been screwed ON

This cannot be said of any other wrench, which is probably why the wrench-user says:

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COES WRENCH CO., Worcester, Mass.